

STANDARDS DEVELOPMENT BRANCH (MOE)



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HAZARDOUS SUBSTANCES PROGRAMME

HAZARDOUS SUBSTANCES LIST AND HANDBOOK

REPORT NUMBER ARB-TDA-33-76

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Ministry
of the
Environment

Ontario

The Honourable
George A. Kerr, Q.C.,
Minister

Everett Biggs,
Deputy Minister

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AIR RESOURCES BRANCH
TECHNOLOGY DEVELOPMENT & APPRAISAL SECTION
REPORT NUMBER ARB-TDA-33-76

AIR RESOURCES BRANCH HAZARDOUS SUBSTANCES PROGRAMME:
HAZARDOUS SUBSTANCES LIST AND HANDBOOK

Ministry of the Environment
Air Resources Branch
880 Bay Street
Toronto, Ontario

JUNE 1976

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01. SUMMARY:

Briefly stated, the objective of the Air Resources Branch's Hazardous Substances Programme (HASP) is to increase the efficiency and sensitivity of the Ministry's response to real, rather than conjectured air pollution problem areas which may be encountered at some future date. A key intermediate stage in attaining this objective is the determination of a detailed, province-wide inventory for a select group of substances which are used in significant quantities in Ontario and which have high acute and chronic toxicity. This is the main subject of this report. The report also summarizes the history of the HASP programme and the nature and course of its future stages.

The select substances on which inventory data are required constitute the Hazardous Substances List (HASL). The rationale, scope, and description of this list is given in section 03. of the report. The list itself is given in the Hazardous Substances Handbook which is section 05. of the report. In view of the fact that the inventory data collection requires intimate knowledge of industries (type and distribution) on a Regional scale, it is obvious that the inventory information could only be provided reliably and efficiently by regional personnel. Accordingly, sections 03. and 04. of the report suggest procedures by which the inventory can be obtained. The Hazardous Substances Handbook (section 05.), which constitutes the bulk of the report, provides background information to assist in collecting inventory data, and most importantly, to assist in estimating actual emissions.

The inventory data will be used to identify a small number of high-priority substances on which to concentrate the resources and efforts of the Ministry of the Environment. Thus, the main responsibility of the Technology Development and Appraisal Section of the Air Resources Branch will be to collect and process all relevant information, including the inventory data, and to compile the priority list. A discussion of this priority-setting process is given in section 04. of the report.

02. INTRODUCTION:

The total number of industrial chemicals to which the general population of Ontario may be exposed is enormous. According to a recent compilation prepared for the Air Resources Branch by James F. MacLaren Limited (section 05.03) there are at least 3000 chemicals which are widely used by Canadian industry in significant quantities. There is mounting evidence that several of these chemical substances may be hazardous to human health when encountered via occupational or environmental exposure. In addition to their inherent toxicity, some chemical compounds may decompose or react with other substances in the atmospheric environment to produce products of high toxicity. This may occur even if the original compounds are relatively harmless. It is obvious therefore that a rational and systematic method must be available to identify and assess potential problem areas in the environment which may arise from the use of these chemicals. The ultimate objective is to be able to quickly recommend and/or implement preventative or remedial action before a serious threat is posed to the community.

Beginning in fiscal year 1975-76, the Technology Development and Appraisal Section of the Air Resources Branch has been authorized by Management Board of Cabinet to initiate and maintain the Hazardous Substances Programme (HASP). Under this programme, potentially hazardous airborne substances are to be identified and assessed, and where necessary, comprehensive investigations are to be conducted on specific high-risk airborne pollutants. This programme is projected to extend over several years.

In order to identify high-priority airborne hazardous substances on which to concentrate Ministry efforts, it is necessary to assess the amounts of each substance actually emitted to the atmosphere. Clearly this assessment need only be carried out relative to the acute and chronic toxic effects of each substance, arising either directly through inhalation or indirectly through deposition from air to soil and water. This obvious but very important point allows the vast number of chemicals used in Ontario to be initially reduced to a manageable

"short list" of substances on which to gather detailed data. This "short list", called the Hazardous Substances List (HASL), is the subject of this report and is given in section 05.01.

In lieu of costly and time consuming source measurements, an estimation of the actual amount of each substance on HASL which is emitted to the atmosphere requires an inventory of the quantity of the substance present at the plant site, and an approximate emission factor. An important phase of the programme, then, is to accumulate quantitative, location-specific inventory data on the HASL substances which may be emitted to the atmosphere. This inventory could only be provided reliably and efficiently by Regional personnel.

The inventory data can be used to develop a prospective, rather than retrospective, approach to dealing with emissions of hazardous air contaminants. The aim of HASP is to generate an "action list" of 5 to 10 highest priority substances for intensive assessment with regard to:

1. Advice to Regions on necessity for abatement activities;
2. Adequacy of sampling and analytical methods for ambient air and source effluents; need for research and development in this area.
3. Preparation of detailed background documentation in support of (1) and (2) above.
4. Development of rationale for environmental air standards.

It is expected that the "action list" will be Region-specific; that is, each Region should have its own priority list of substances which require intensive activities. In this regard, the feedback of inventory data from each Region will therefore be considered separately by TDA in setting Regional priorities and in the course of developing an overall list of Ministry priorities. It is also expected that priority setting will be a dynamic rather than a static process, and that priorities will undergo continual re-evaluation and re-ordering, on the basis of the information which is submitted to TDA by the

Regions and the latest results of research. Decisions on re-ordering of priorities will be communicated back to the Regions. Thus the successful operation of the programme will depend upon feedback from the Regions to TDA and vice versa on a continuing basis. This should lead to optimum refinement of priorities and dedication of manpower.

The HASP programme has already produced several comprehensive reports on a few hazardous airborne substances, principally asbestos and vinyl chloride.

In order to coordinate and oversee activities associated with the Hazardous Substances Programme, the Executive Committee of the Ministry has approved the formation of an Hazardous Substances Committee (HASC). The terms of reference of HASC will be:

1. To provide an intra-ministerial forum for:
 - a) the identification and assessment of potentially hazardous airborne materials on the basis of information provided by the Ministry of Health and other health protection agencies.
 - b) the evaluation of Technology Development and Appraisal Section's reports or summaries on process and control technology, sampling and analytical techniques, sources and source strengths of hazardous materials, which have been prepared with the assistance and cooperation of other branches or agencies.
 - c) the discussion and preparation of recommendations for action on actual or potential problem areas.
2. To provide advice to environmental air standards-setting committees on airborne hazardous substances.
3. To coordinate and expedite the dissemination of information on airborne hazardous substances, particularly to the regional offices.

The composition of HASC will be 3 representatives from the Air Resources Branch (2 TDA, 1 AQM); 1 representative from each of the following branches and divisions:

Water Resources Branch
Laboratory Services Branch
Pollution Control Branch
Regional Operations Division

Additional information about the formation and activities of this committee will be forthcoming.

03. PROGRAMME OVERVIEW

03.01 Background

A list of potentially hazardous airborne contaminants was drawn up in 1974 on the basis of replies to a questionnaire sent to major air pollution regulatory agencies in North America. These agencies were asked to list those substances or classes of substances which were (1) regulated, (2) scheduled for regulation, or (3) under study in their respective jurisdictions. The list which was compiled from these replies contained 52 chemicals or general classes of chemicals and was not specific to usage or potential emissions in Canada or Ontario.

In order to evaluate the hazard potential in Ontario of the substances on the above list, the following steps were taken during 1975:

1. The list of 52 substances was circulated to the six Regional Offices for comments and for a preliminary indication of their current priorities with respect to materials on this list which were known to be used or produced by industries in their Region. Replies were received from all Regions.
2. An intensive survey of the literature (both open and limited circulation) was undertaken to provide the information necessary to assess (a) current knowledge of human health effects of substances on the list, (b) Ministry capability to sample for and analyse contaminants of interest, (c) potential sources and emission factors. A file of copies of relevant documents was established for each of the 52 substances. A card subject index was prepared for all documents in the file.
3. James F. MacLaren Ltd. were contracted to compile a computer-compatible data base of information on selected industrial chemicals known or supposed to be used in Ontario. This data base (section 05.03) comprises about 2500 individual chemical compounds, covering essentially all of the 52 substances of the original list.

03.02 Scope

It is important to state the working definition of the phrase "potentially hazardous substance." For the purpose of this programme, the Air Resources Branch is concerned only with industrial emissions of specific chemical compounds. A hazardous substance is taken as one which poses an identifiable threat to community health in the quantity in which it is emitted to the environment, specifically to the atmosphere. Thus, although a substance may be highly toxic to humans, it is not hazardous unless there is an opportunity for exposure. In this context, the concept of "harmful quantity" has been widely used. This is the quantity which will produce an adverse effect on an individual receptor.

Information gathered during this programme is to be used to assess adverse effects on health of the general human population due to chemical substances emitted by manufacturing and processing industries. The harmful quantity of a pollutant, then, may be referred either to the local community surrounding the emitting plant or to a much larger receptor population depending on the nature of the chemical substance and the degree of atmospheric transport.

A substance is to be considered hazardous, then, if its typical short term or long term (depending upon its toxic properties and persistence) atmospheric concentration in the vicinity of a receptor population is sufficient to cause adverse human health effects to any member of the community. The emphasis is on harm which may arise from typically low level atmospheric concentrations which persist over critical periods of time, and not on atypical crisis situations which may produce a harmful concentration as a result of an accident or spill.

It should be noted that the range of influence of a source may extend well beyond the immediately adjacent community for tens or even hundreds of kilometers, depending upon the nature of the emitted substance and prevailing

meteorological conditions.

Entries on the Hazardous Substances List (HASL) should properly be referred to as "potentially hazardous", since we do not yet know whether these materials are emitted in harmful quantities in Ontario. To reiterate, for the purposes of this programme, a substance should not be considered "hazardous" unless it is normally emitted in harmful quantity somewhere in Ontario.

The primary basis for action in controlling environmental air contaminants is their direct or indirect (e.g., food supply) effect on human health. Secondary concerns are effects limited to animals, vegetation, materials, etc. In order to establish a tractible preliminary "short list" of potentially hazardous substances, namely HASL, it was decided to use two criteria: severity of human health effects through inhalation and the extent of usage and production. A rough ranking index was calculated as the ratio of the total amount of substance used or produced in Canada to the Ontario Occupational Health Guideline concentration (Threshold Limit Value) for inhalation of that substance. The amounts used or produced in Canada were compiled by J.F. MacLaren Ltd. in a 1974 report to Environment Canada (Reference 2 of section 05.05) and for the Air Resources Branch in the 1976 data base compilation (section 05.03). These amounts, of course, do not necessarily bear any specific relationship to the amounts used or produced in Ontario, but they provide the only reasonable estimates of usage available to us at this time.

The Hazardous Substances List (HASL) which is presented in section 05.01 of this report consists, therefore, of those substances for which an Occupational Health Guideline (TLV) has been published and for which a recent semi-quantitative estimate of Canadian usage is available. In addition, some substances have been added to HASL for which no usage data is available but which are thought to be used in large volume in Ontario and whose toxicity to humans is known or believed to be significant in low-dose chronic environmental exposures. Another group of substances which are known carcinogens have been

included without regard to potential occurrence in Ontario but for which inventory data collection is important.

Entries on HASL have been selected, somewhat subjectively, on the basis of:

1. Severe health effects.
2. Quantity present.
3. Likelihood of entering atmosphere in harmful amounts.
4. Persistence in the atmosphere.

The rationale behind the selection and categorization (priority assignment) is discussed in section 03.03 below.

A "short list" such as has been drawn up cannot pretend to be an exhaustive compilation of all potentially serious chemical hazards to public health. HASL is an attempt to focus attention within the Ministry on those substances which are implicated by current information as likely air contaminants near industrial sites in Ontario. The list is believed to contain most chemical substances which may present atmospheric contamination problems in the future. Completeness of HASL will improve as feedback from the field allows additions and deletions to be made. This fact underscores the important role to be played by the Ministry's Regional Offices.

The Hazardous Substances List, then, should serve as a reliable guide to the industrial chemicals or families of industrial chemicals for which data to assess atmospheric emissions of the industrial sector in Ontario will be required.

The Hazardous Substances List and Handbook are the precursors of a detailed localized inventory of (1) quantity of a given substance present at a site, (2) the identity and location of the user together with information on the industrial process involved, and (3) an estimate of the quantities of substances present which are emitted to the atmosphere. Inventory data will be

generated from direct contact inquiries by District Officers of appropriate industries in their districts. Certain data, as outlined in a subsequent section, are provided in the Handbook for assisting District Officers in identifying types of plants at which a substance might be expected to be found.

Not all substances in the List and Handbook will occur in all Regions. Regional and District personnel must use their best judgement based on experience and accumulated knowledge of their locales to sort out which of the entries on the list to pursue. It is very likely that each Region will discover large volume, potentially hazardous chemicals which have been omitted from HASL. This is inevitable, and such information will be incorporated in revised versions of the list.

03.03 Description of the Hazardous Substances List:

In an attempt to prioritize the HASL, substances have been placed in one of three categories. All entries on the List have been selected because of their severely toxic (human health) effects at low to moderate dose levels (expected environmental doses).

Category A comprises those substances which are judged capable of causing irreversible acute response or chronic illness as a result of a single or brief exposure to a relatively small quantity (low dose). Substances in this category should be considered of highest priority.

Category B, by far the largest on the List, includes those substances which may cause chronic health effects as a result of exposure to a low concentration (typical of environmental exposure) over a long period of time. These health effects include carcinogenesis, mutagenesis, teratogenesis, etc. Substances in this category should be considered high priority. The subgroup within Category B which are termed "carcinogens" consists of substances which are officially recognized by the U.S. Occupational Safety and Health Administration (OSHA) to be carcinogenic in man.

Category C includes substances which have known moderate to high

acute (single or brief large dose) inhalation toxicity but which have low chronic inhalation toxicity or short atmospheric persistence (measured or conjectured). Substances in Category C are more often considered hazardous in the event of a large spill which might create a large local concentration over a short period of time. In this context they have been and continue to be the prime concerns of the Contingency Planning Section, Pollution Control Branch. Many of the substances in this category persist for relatively short periods of time in the atmosphere because of their high chemical reactivity. Persistent substances in this category are not thought to produce chronic health effects on the basis of current information.

Within a category, substances are listed in order of decreasing estimated usage. This is intended to give a rough priority to the substances. Several important classes of substances have been omitted from HASL in order to keep the scope of the project within manageable limits. These classes are discussed below.

"Common" or well-known pollutants, such as vinyl chloride, asbestos, polychlorinated biphenyls, etc. have been excluded from the HASL because detailed emission inventory data have been gathered already or are in the process of being collected as a result of earlier requests. Brief summaries of pertinent data on these substances have been included in section 05.04 of the Handbook. Other common hazardous pollutants, such as sulphur dioxide, which are monitored routinely in the Ontario Air Quality Network are not treated at all in HASP, although they are important in on-going Ministry programmes.

Phytotoxicants have been excluded because of the specialized nature of research in this area - very few industrial chemicals have been evaluated for toxic effects on vegetation and even fewer have been identified as phytotoxic. Other than the common air pollutants, ethylene and boron compounds are the major known phytotoxic materials of importance in Ontario industry. As the

project develops and more information becomes available, this category may be included. For the present, the survey should concentrate on substances with severe human health effects.

In the same context, substances whose environmental effects are primarily as odours or in soiling and corrosion of materials have not been included in the list.

Pesticides and herbicides have not been included in this survey of potentially hazardous atmospheric pollutants because their mode of usage precludes a straightforward inventory of emissions and because they are the prime interest of the Pesticides Control Section which is responsible for administering their licensing, distribution and use under the Pesticides Act. They are definitely important as air pollutants because of their mode of application (spraying) and their atmospheric persistence, but again, it is difficult to include them within the scope of the present survey, since the important route of entry into the environment is not likely to be from well-defined industrial sources, that is, manufacturers.

03.04 Description of Hazardous Substances Handbook:

The Handbook consists of the Hazardous Substances List (section 05.01) and various supplementary materials (sections 05.02 to 05.05) which are intended to provide background information to assist in collecting inventory data and assessing potential emissions. The data sheets (section 05.05) provide only very basic information. These sheets are not exhaustive compilations of recent scientific findings but are instead summaries of a few pertinent data from standard reference sources. Comments based on the Special Studies Unit's reading of the current literature and on the extensive files accumulated since the start of the programme have been added to the data sheets to indicate important aspects or to place the given information in context.

As an aid to tracking down the locations of quantities of chemicals, the industrial sectors in which they are likely to be found are listed, both

on the data sheets (section 05.05) and in the Industrial Sector Table (section 05.02). Estimates of the relative quantities of a substance present in each of several industries are given wherever possible. It must be emphasized that these data are merely guides for planning an approach to assembling an inventory. Detailed information of this sort is not readily available, and one of the prime reasons for conducting the project, of course, is to obtain good data on use and distribution of hazardous substances in the Province.

The various sections of the Handbook, particularly the Industrial Sector Table (section 05.02), provide suggestions on specific chemical compounds of the general elemental (metallic) substances on the HASL which are of concern because of their suspected use in Ontario. However these should not be considered restrictive. These chemicals, then, should provide a starting point in concentrating attention in the initial stages of the survey, but as the project develops (over a period of several years) it is hoped that all toxic chemicals used in large quantity by Ontario industry will be inventoried.

04. USE OF HAZARDOUS SUBSTANCES LIST

04.01 Information Processing:

As stated earlier, a detailed inventory is requested for each substance on HASL. This is an important phase of the overall Hazardous Substances Programme and is designed to provide the following key information:

1. The quantity of a given substance present at a site.
2. The identity and location of the user including the specific industrial applications and processes.
3. An estimate of the quantity of the substance actually emitted to the atmosphere (source strengths or emission factors).

Since substances in Category A have high acute and chronic toxicity, they should receive first attention in approaching local industries. Category B substances, which include many proven or suspected carcinogens, are to be considered of somewhat lower priority, although they should eventually also command Regional attention. Relative priorities have been given to the substances within each category, based on approximate usage data, and it is recommended that they be investigated in roughly the indicated order. However, this is not a rigid requirement, and each Region may wish to arrive at its own ordering scheme based on local usage. It should also be reiterated that the Hazardous Substances List is not intended to be exhaustive or exclusive. The specific compounds, particularly of the metallic elements, which are given in the Industrial Sector Table (section 05.02) are of concern because of their suspected use in Ontario, but they are only suggestions of compounds to pursue. Under the HASP programme, TDA is interested in obtaining inventory and other information on any substances which the Regions view with concern.

The Special Studies and Programme Planning Unit of TDA is preparing a questionnaire which is intended to provide a uniform format for collecting and reporting the inventory data. This questionnaire will shortly be sent to the Regions under a separate cover.

The Technology Development and Appraisal Section will be responsible for collecting and processing the inventory data from all six Regions. Of course, all data (#1, 2, 3 above) should be reported to TDA as soon as they are available. However it should be emphasized that the data on the quantity of a given substance present at a site, and the identity and location of the user (#1, 2 above) should be reported as soon as they are gathered, and should not be delayed until the estimate on the actual emissions (#3 above) is complete. These inventory data will be compiled, along with source test results obtained by the Source Testing Unit of TDA, in a computerized system so that all data will be immediately accessible. Some of the information which is sought is already available in the form of Section 84 (Environmental Protection Act) reports and other documents associated with Environmental Approvals certificates for new or recent plant construction. Some data of this sort have been provided to the Contingency Planning Branch of the Ministry and to Environment Canada as part of various hazardous substance inventories which have been carried out. None of the previous inventories has been as complete or comprehensive as the present one, but all of the accumulated data will be collected by TDA and incorporated into the current inventory.

It is also anticipated that eventually the programme will be broadened to include information of more direct use to the Water Resources, Pollution Control, and Environmental Approvals Branches of the Ministry. It is recognized that environmental problems are not confined to a single medium, but are of course multi-media problems encompassing air, water, soil, solid waste, etc. This fact should be kept in mind while gathering and supplying inventory data.

An important aspect of the overall HASP programme, particularly information processing, will be the feedback mechanisms whereby update information on the programme will be communicated by TDA to the Regions and vice versa. Feedback from TDA will take the form of newsletters and revised data sheets to be inserted in the Hazardous Substances Handbook. The format of the various

sections of the Handbook has been designed so that this could be carried out in a consistent manner (for details, see Explanatory Notes, section 05.06). The communication will include notification of priority setting (both on Regional and overall Ministry levels) and changes in priorities, additions to the Hazardous Substances List, research and development results relevant to airborne contaminants, as well as information on other matters pertinent to HASP.

A mailing list will be maintained and all revisions and additions to the Handbook will be circulated to all parties. Revisions and additions to the Handbook will be dated.

04.02 Priority Setting

The information obtained from the Regions under this phase of the HASP programme will be used to generate a Regional-specific "action list" of 5-10 highest priority substances for intensive background information collection and assessment. However, the inventory information, particularly the estimated actual emissions of each HASL substance is not the only input to be used in this priority-setting process. Two important criteria in addition are the specific health hazards associated with each substance, and the population which may be affected. The responsibility for this assessment and priority-setting will be assumed by TDA. The progress achieved in the setting of priorities will be communicated to the Regions as described in section 04.01.

It is anticipated that each substance, identified by the "action list" as high priority, will be the subject of a comprehensive background study and report. Various aspects of a specific pollutant may need to be investigated or summarized. These may include:

1. Physical and chemical properties.
2. Potential sources of atmospheric emissions.
3. Process and control technology for reducing emissions.

4. Available sampling methods and analytical techniques and detection limits. Research and development needs in this area are to be identified.
5. Nature, persistence, and fate of the pollutant in the atmosphere.
6. Environmental impact taking into account health effects, population affected, phytotoxicological effects, and soiling, corrosion, and odor characteristics.

In particular, source testing programs and/or ambient air monitoring programs may be recommended and subsequently implemented. Thus, in keeping with the ultimate objective of the HASP programme as stated in the Introduction, the Ministry of the Environment will attempt to anticipate future problem areas before they reach a critical stage.

05. HAZARDOUS SUBSTANCES HANDBOOK

05.01 Hazardous Substances List

Category A Compounds

05.01.01

Lead and Lead Compounds*

Nickel and Nickel Compounds*

Cobalt and Cobalt Compounds*

Maleic Anhydride

Cadmium and Cadmium Compounds*

Mercury and Mercury Compounds*

Chromium and Chromium Compounds*

Chrome Pigments (e.g., Lead Chromates)

Barium and Barium Compounds*

Selenium and Selenium Compounds*

Antimony and Antimony Compounds*

Arsenic and Arsenic Compounds*

Acrylamide

Tellurium and Tellurium Compounds*

Phosphorus

Chlorine Dioxide

Beryllium and Beryllium Compounds*

Hydrocyanic Acid

Vanadium and Vanadium Compounds*

Toluene - 2,4 - Diisocyanate

* See Industrial Sector Table (Section 05.02)

Category B Compounds

05.01.02

Kerosene

Asphalt

Sulfuric Acid

Copper and Copper Compounds*

Benzene

Carbon Black

Iron and Iron Compounds*

Hydrogen Chloride

Nitric Acid

Toluene

Aniline

Xylenes

Styrene Monomer

Phenol

Carbon Tetrachloride

Phthalic Anhydride

Molybdenum and Molybdenum Compounds*

Ethylene Oxide

Phosphoric Acid

Ethyl Chloride

Vinyl Acetate (Monomer)

Zinc and Zinc Compounds*

Ethylene Dibromide

Hydrogen Fluoride (Hydrofluoric Acid)

Methyl Chloride

Vinylidene Chloride

Magnesium and Magnesium Compounds*

Chlorobenzene

Manganese and Manganese Compounds*

Category B Compounds (cont'd)

Trichloroethylene

Naphthalene

Chloroform

Methylene Chloride

p - Dichlorobenzene

Cresols

Oxalic Acid

Morpholine

Cyanogen

Carcinogens

2 - Acetylaminofluorene

4 - Aminobiphenyl

Benzidine (and its salts)

3,3' - Dichlorobenzidine (and its salts)

Dimethylaminoazobenzene

Naphthylamine (α and β)

4 - Nitrobiphenyl

N - Nitrosodimethylamine

β - Propiolactone

bis - Chloromethyl Ether

Methylchloromethyl Ether

4,4' - Methylene (bis) 2 - Chloroaniline

Ethylenimine

Dimethyl Sulfate

Hexavalent Chromium compounds (Chromates)

Category B Compounds (cont'd)

Additional Hydrocarbons and Chlorinated Hydrocarbons (no Canadian usage data is available)

Ethylene Dichloride

Tetrachloroethylene

1,1,1 - Trichloroethane

Chloroprene

Ethyl Benzene

Cumene

Coal Tar and Pitch

Creosote

* See Industrial Sector Table (Section 05.02)

05.01.03

Category C Compounds

Compounds with Low Chronic Inhalation Toxicity
or Short Atmospheric Persistence

Titanium Dioxide

Chlorine

Ammonia

Formaldehyde

Acetaldehyde

Acetic Acid (Glacial)

Ethanolamines

Sodium Cyanide

Pentaerythritol

Acrylonitrile

Ammonium Chloride

Formic Acid

Resorcinol

Dibutyl Phthalate

Acetonitrile

Iodine

Sodium Fluoride

Carbon Disulfide

Phosgene (Carbonyl Chloride)

Phosphine

05.02 Chemical Usage Identified by Industrial Sector

05.02.01 Code for Industrial Sectors:

<u>CODE NUMBER</u>	<u>INDUSTRY TYPE</u>	<u>COMMENTS</u>
1-6	INORGANIC CHEMICALS	
1	Industrial Gases	Establishments producing gases such as oxygen, nitrogen, hydrogen, and carbon dioxide.
2	Chlor-Alkali	Establishments producing chemicals such as soda ash, caustic soda, and chlorine.
3	Electrolytic	Establishments producing chemicals by the aid of electricity.
4	Sulphur and Sulphuric Acid.	
5	Other Inorganic	Other Inorganic Chemical Industries.
6	Total Inorganic Use	Indicates the percentage of the total quantity used by the Inorganic Chemical Industries.
7	ORGANIC CHEMICALS	
8-12	MISCELLANEOUS CHEMICALS	Establishments primarily engaged in manufacturing chemical products, not elsewhere classified.
8	Explosives	Establishments producing chemical explosives and ammunition.
9	Pesticides	
10	Photographic	
11	Other Miscellaneous	Establishments producing miscellaneous products such as adhesives, polishes, etc.
12	Total Miscellaneous	Indicates the percentage of the total quantity used by MISCELLANEOUS CHEMICAL INDUSTRIES.
13	IRON AND STEEL	Establishments having blast furnaces steel mills, rolling mills, coke ovens or some combination of these.
14	POWER	
15	REFINERIES	Establishments primarily engaged in refining crude petroleum or in

CODE NUMBER	INDUSTRY TYPE	COMMENTS
15 (cont'd)		blending products such as lubricating oils and greases.
16	BEVERAGES	Breweries Distilleries Wineries Soft drink manufacturers
17	OILS, FATS, WAXES	
18	TEXTILES AND LEATHER	Leather Tanneries Textile Dyeing and Finishing Plants
19	CEMENT	
20	CERAMICS	Clay Products Manufacturers- Domestic Clay Products Manufacturers- Imported
21	WATER AND WASTE TREATMENT	Information was available on the use of chemicals by municipal waterworks only.
22	PLATING	
23	PHARMACEUTICALS AND MEDICINE	Manufacturers of Pharmaceuticals and Medicine Manufacturers of Toilet Preparations
24	SOAP AND CLEANING COMPOUNDS	
25	BATTERY MANUFACTURERS	
26	PULP AND PAPER	
27	PRINTING INKS	
28	PIGMENTS AND DRY COLOURS	
29	PAINT AND VARNISH	Includes manufacturers of putty, filler, oil stains, and thinners.
30	PLASTICS AND SYNTHETIC RESINS	
31	RUBBER	
32	GLASS AND GLASS PRODUCTS	
33	SUGAR	
34	FERTILIZERS	Establishments primarily engaged in manufacturing mixed fertilizers. Does not include production of pure chemicals.

CODE NUMBER	INDUSTRY TYPE	COMMENTS
35	OTHER INDUSTRIES	Indicates use of a chemical compound other than those contained in Codes 1-34

Quantity Code: AS - shipped
E - exported
EU - exported plus used
I - imported
P - produced
PI - produced plus imported
S - sales
U - used
PIU - produced plus imported plus used.

NOTE* Numeral in brackets () indicates the percentage of the total quantity present which is associated with the specific industrial sector.

05.02.02 Industrial Sector Table:

		<u>Quantity (tons)</u>
Acetaldehyde	7(99%)	U 43560
Acetic Acid	5,6(.1%),7(11%),9,10,11,12(.1%),18(3%),23,28(.5%), 30(85%),35	U 16155
Acetonitrile	7,15,17,23	I 205
2 - Acetylaminofluorene		
Acrylamide	11,18,21,28,29(99%),30,35	U 60
Acrylonitrile	7,30,31	I 1845
4 - Aminobiphenyl		
Ammonia	1,2,5,6 (36%),7(5%),11,12 (27%),13,15,21,26(33%),28,30,31 34(9%),35	PIU 353147
Ammonium Chloride	5,22(26%),23,25(46%),30,31(28%),34,35	U 1640
Aniline	7,8,9,10,23	
Antimony Potassium Tartrate	9,18,23	I 20
Antimony Trichloride		
Antimony Trioxide		I 422
Arsenic	32(99%),35	U 140
Arsenic Trioxide	5,9,12(99%),18,20,29,32	U 2 65
Arsenic Trisulfide		
Arsine		
Asbestos		P 1,654,000
Asphalt		P 2585000
Barium	35	
Barium Acetate	18,29	
Barium Carbonate	2,6(97%),7(3%),9	I 3600
Barium Chloride	2,6(74%),18,28(26%)	U 485
Barium Chromate	8,28	
Barium 2-Ethylhexoate	27,30	
Barium Ferrite		
Barium Hydroxide		

	Quantity (tons)
Barium Naphthenates 27,28	
Barium Nitrate 7,8	
Barium Nonyl Phenate 30	
Barium Oxalate 7	
Barium Stearate 8,30,31	
Barium Sulphate 10,29,30	
Barium Trinitrophenol glucinate 8	
Benzene 5,7(96%),15(3%),29(.3%),35	PI 300838
Benzidine	
Benzidine Yellow Xylidine 29(99%)	U 55
Beryllium 35	U 0.3
Beryllia Ceramics 20	
Beryllium-Aluminum Alloys 35	
Beryllium-Copper Alloys 35	
Beryllium Oxide	
Cadmium and Compounds	P 926
Cadmium Benzoate 30	
Cadmium Chloride	
Cadmium Cyanide 22	
Cadmium 2-Ethylhexoate 29	
Cadmium Nitrate 28(99%),32	U 5
Cadmium Oxide	
Cadmium Selenide 28(99%)	U5
Cadmium Stearate	U5
Cadmium Sulphate 22,28(99%)	U5
Cadmium Sulphide 8,20,28(99%)	U5
Cadmium Sulphoselenides 28(99%)	U5
Carbon Activated 5,6(1%),7(23%),21(69%),28(1%),33(6%)	U 1065
Carbon Black 11,12(.2%),27(1%),29(1%),30,31 (97%)	U 86280

	Quantity (tons)
Carbon Disulphide 5,6(99%), 30	U 50
Carbon Tetrachloride 5,6(39%),7(59%),9,12(1%),34(.4%)	U 18445
Carbonyl Chloride (Phosgene) 7,9,28	
Chlorine 1,2,5,6(5%),7(7%),9,15,18,21,24,26(85%),28,30	PI 849926
Chlorine Dioxide 4,17,21(99%),26	U 25
Chlorobenzene 9,15,29	I 2580
Chloroform 9,15,28	I 1660
<u>bis</u> - Chloromethyl Ether	
Chloroprene	
Chrome Pigments 28(99%)	U 1455
Chromic Acid 18,22,27	
Chromite	
Chromium Acetate 18	
Chromium Lignosulphonates 18	
Chromium Sulphate	I 1356
Coal Tar and Pitch	
Cobalt Acetate 7(99%),27,28,29	U 10
Cobalt Blue 28 (99%)	U 1
Cobalt Ethylhexoate 29	
Cobalt Decanoates 27	
Cobalt Linoleate 29	
Cobalt Naphthenates 29	
Cobalt Soaps 29 (99%)	U 325
Cobalt Tallate 29	
Cobalt Tetracarbonyl	
Copper 2-Ethylhexoate 29	
Copper Naphthenate 9,29	
Copper Oleate 9,23,35	
Copper Oxides 7,9,13,20,22,23,25,29,30,32	I 105

	Quantity (tons)
Copper β -Quinolinolate 9	
Copper Sulphate 9,12(69%),13,18,21(31%),22,23,25,31	I 2270
Copper Tallate 29	
Creosote 23,35	
Cresols 7(14%),11,12(25%),18,30(61%)	I 685
Cumene 7	
Cumene Hydroperoxide 7,30	
Cupric Acetate 9,31	
Cupric Chloride 8,9,10,15,21,27	
Cupric Citrate	
Cupric Dichromate	
Cupric Nitrate 10,22,29	
Cupric Salicylate	
Cyanogen	
Cyanogen Iodide 23	
Dibutyl Phthalate 7,8,10,29(37%),30(63%)	U 320
1, 2 - Dichlorobenzene 9,18,22,28,30	
1, 4 - Dichlorobenzene 9,12(99%),22,28	U 740
3,3'-Dichlorobenzidine	
Dimethylaminoazobenzene	
Dimethyl Sulfate	
Ethanolamines 24(99%)	AS 9648
Ethylbenzene 30	
Ethyl Chloride 7(99%),9,17	U 13455
Ethylene 7,30	P 448064
Ethylene Dibromide 7(99%),9,15,23,30	I 8615
Ethylene Dichloride 7,15,24,30	

Ethylene Oxide	7(76%),15,24(24%),30	U 15675
Ethylene Thiourea		
Ethylenimine		
Ethylnitrosonitroguanidine		
Ferric Chloride	10,21,23,28	
Ferric Nitrate	18,22,23	
Ferrocene		
Ferrophosphorus	13	
Ferrosilicon	13	
Ferrous Fumarate	23	I 10446
Ferrous Phosphide	13	
Ferrous Phosphogluconate	23	
Ferrovanadium		
Formaldehyde	5,6(9%),7(2%),11,12(7%),18,23,29(3%),30(79%)	P 63802
Formic Acid	5,6(6%), 18(94%)	I 960
Hydrochloric Acid	5,6(74%),7(8%),11,12(3%),22(3%),23(2%) 26(6%),28(2%),30,32,33	U 70175
Hydrocyanic Acid		
Hydrofluoric Acid	5,6(37%),7(63%)	U 4795
Hydrogen Chloride, Anhydrous	7,30	
Hydrogen Peroxide	7,16,18(24%),22,26(76%)28,30,31	U 1790
Hydrogen Sulphide	5,7,35	
Hypophosphorus Acid	22	
Iodine	5,22,23(99%),28	I 200
Iron Blue	27,28,29(99%),34	U 55
Iron 2 - Ethylhexoate	30,31	

	<u>Quantity (tons)</u>
Iron Naphthenate 28,29	
Iron Oxides 19(96%),22,28,29(4%)	U 73460
Iron Oxide, Synthetic 28,29	
Iron Selenide 13	
Iron Sorbitol 23,29	
Iron Tallate 28,29	
 Kerosene	 PI 2,860,000
Lead	PI 206749
Lead Acetate 9,18,23,28,29	
Lead Azide 8	
Lead Azotetrazole 8	
Lead Carbonate 20,28,29(99%)	U 490
Lead Chloride 5,28	
Lead Chromate 28	
Lead Dinitroresorcinat 8	
Lead 2- Ethylhexoate 28,29	
Lead Fluoborate 22	
Lead Fumarate 30	
Lead Isodecanoate 29	
Lead Monoxide 5,6,7 (3%),11,12,18,20,23,25(74%),27,28(21%),29,31	U 10325
Lead Naphthenates 15,29,30	
Lead Neodecanoate	
Lead Nitrate 8,10,18,28,29	
Lead Oxides 20,25,29,35	
Lead Perchlorate	
Lead Phosphite 29,30	
Lead Phthalate 30	
Lead Silicate 20,30(99%), 35	U 280
Lead Stearate 15,29,30	
Lead Styphnate 8	

	Quantity (tons)
Lead Sulphate 7(99%),20,28,29,30	U 160
Lead Tellate 28,29	
Lead Tetroxide 20,25(99%),28,29	U 280
Lead Tetraethyl	
Lead Trinitrophenylglucinate 8	
Magnesium	PI 11876
Magnesium Acetate 18,23,28	
Magnesium Bile Salts 23,24	
Magnesium Calcium Carbonate 18,26	
Magnesium Chloride 18,19,26,35	
Magnesium Hydroxide 26,28,33	
Magnesium Lauryl Sulphate 24	
Magnesium Lignosulphonates 9,18,19,28	
Magnesium Naphthenate 28,29	
Magnesium Nitrate 8,35	
Magnesium Oxide 13,19,23,26,31,34(99%),35	U 2685
Magnesium Salicylate 23	
Magnesium Silicate 17,20,26,29,30,31,32,35	
Magnesium Stearate 28,29,30,35	
Magnesium Sulphate 18,20,23,(84%),28,34(16%)	U 855
Magnesium Xylene Sulphonate 30,31	
Maleic Anhydride 7(7%),17,18,28,29(35%),30(58%)	U 1665
Manganese 13	I 2545
Manganese Carbonate 18,22,23	
Manganese Dioxide 8,25(50%),28,29(50%)	U 4400
Manganese 2-Ethylhexoate 27,28,29	
Manganese Isodecanoate 30	
Manganese Linoleate 23,29	
Manganese Naphthenate 29	

	Quantity (tons)
Manganese Neodecanoate 30	
Manganese Soaps 29(99%)	U 90
Manganese Sulphate 9,20,22,29	
Manganese Tallate 29	
Mercuric Chloride	
Mercuric Nitrate 7,23	
Mercuric Oxide	
Mercurous Nitrate 7,23	
Mercury	PI 335
Methyl Chloride 7(99%), 9,15,30,31	U 3215
Methylchloromethyl Ether	
4,4' - Methylene (<u>bis</u>) 2- Chloroaniline	
Methylene Chloride 7,9,10,18,23,29(99%),30	U 915
Molybdate Orange 27,29(99%),30	U 545
Molybdenum Disulphide 15,30,35	
Molybdenum Oxides 7,22	
Molybdenum Trioxide 15,20,22,23,28	I 35
Morpholine 7, 17,24,31	I 305
Naphthalene 8,9,12(99%),18,30	U 1675
Naphthylamine	
Nickel Carbonate 20,22	
Nickel Carbonyl	
Nickel Chloride 22	
Nickel 2- Ethylhexoate 27,28,29	
Nickel Ferrite 13	
Nickel Oxide 5,20,26	
Nickelous Acetate 18	
Nickel Selenide 13	
Nickel Subsulfide	
Nickel Sulphate 11,18,20,22	
Nitric Acid 5,6(.9%),7(96%),15,23,28(3%)	U 54160
4 - Nitrobiphenyl	
N-Nitrosodimethylamine 10	

	Quantity (tons)
Oxalic Acid 12(99%),18,22,25	I 435
Pentaerythritol 8,9,23,29(58%),30(42%)	U 3800
Phenol 7(14%),9,12,(3%),15(2%),23,29,30(80%)	U 29595
Phenol Formaldehyde Resins 29(99%),30	AS 44260
Phenol Sulphonic Acid 22,23,28,35	
Phosphine	
Phosphoric Acid 5,6(68%),7(11%),11,12(15%),15,16,17,18,20,21,22,23, 24,29(3%),33(2%),34	AS 13508
Phosphoric Anhydride 5,7,23,30,33,35	
Phosphorus, Amorphous 5,8,12(99%)	U 25
Phosphorus Sesquisulphide 7,12(99%)	U 10
Phosphorus, Yellow 5,6(99%),8,9,22,34	U 24370
Phthalic Anhydride 5,6,7(14%),9,12(5%),23,28,29(36%),30(44%)	U 18390
Polychlorinated Biphenyls (PCB's)	U 500
β - Propiolactone	
Resorcinol 7,23,28,30,31	I 735
Resorcinol Resins 30(99%)	U 245
Selenium Compounds	P 426
Selenium Diethyldithiocarbamate 31	
Selenium Dioxide 23,35	
Selenous Acid 35	
Sodium Arsenate	
Sodium Cyanide 5,22,28,30,35	I 4760
Sodium Fluoride 9,12,(99%),13,21,22,23,32	U 152
Styrene-Acrylic Copolymers	
Styrene-Acrylonitrile Copolymers	
Styrene Monomer 29(6%),30(94%)	U 37250
Sulphur Dioxide 4,5,15,16,21,26(99%),35	U 39095

Sulphuric Acid	4,5,6 (48%),7(5%),8,10,12(2%),13,15(4%),18,21,22,24 (2%),25,26(14%),28(14%),29,30(3%),33,34(6%),35	PI 273926
Sulphur Trioxide	4,5,24	
Tellurium		P 33
Tellurium Dioxide	13,35	
Tetrachloroethylene		
Tetraethyllead	15	
Tetramethyllead	15	
Titanium	13,22,35	I 290
Titanium Carbide	35	
Titanium Dioxide		PI 855659
Titanium Sulphate	28	
Titanium Tetrachloride	5,28,32	
Toluene	5,6,7(55%),8,12(5%),15,24,29(36%),30(3%), 31	U 54113
Toluene 2, 4 - Diisocyanate	30	
Toluene Sulphonic Acid	7,28	
1,1,1, - Trichloroethane		
Trichloroethylene	7,9,17,24(67%),29(33%),35	I 2080
Vanadium Naphthenate	29,30	
Vanadium Pentoxide	4,7,10,14,18,20,23,35	
Vanadium Trioxide		
Vinyl Acetate Monomer	11,12(50%),29(11%),30(39%)	U 11125
Vinyl Acetate Copolymer Resins	29(99%),30	U 72
Vinyl Chloride Monomer	29(99%),30	PIU 130,000
Vinyl Chloride Copolymer Resins	29(99%),30	U 760
Vinylidene Resins	30	
Vinylidene Chloride		I 2760
Vinyl Monomers	30(99%)	U 39430

	Quantity (tons)
Xylenes 7(58%),9,12(6%),15,23,28,29(32%),30(3%)	U 49180
Zinc	UE 468785
Zinc Acetate 18, 23,28,35	
Zinc Ammonium Bisulphite 34	
Zinc Ammonium Chloride 22,25,35	U 105
Zinc Chloride 5,6(2%),7(2%),15,18,22,25 (96%),28,32	U 635
Zinc Chromate 29(99%),35	
Zinc Dibutyl Thiocarbamate 15,30	
Zinc Diethyl Thiocarbamate 30,31	
Zinc Dust 5,8,28,29,30	I 711
Zinc 2-Ethylhexoate 30,35	
Zinc Hydrosulphite 23,26(99%)	U 7255
Zinc Isodecanoate 30	
Zinc Laurate 29	
Zinc Lignosulphonates	
Zinc Mercaptobenzothiazole 9,31	
Zinc Naphthenates 9,29,30	
Zinc Neodecanoate	
Zinc Nitrate 7,23,30,35	
Zinc Oxide 7(1%),10,12 (2%),20,23,28(4%),29(10%),30,31(82%)	U 10205
Zinc Peroxide 23,35	
Zinc Selenide 10,35	
Zinc Stearate 23(99%),28,29,30	U 15
Zinc Sulphate 5,9,12(99%),18,26	I 1660
Zinc Tallate 30,31	

Additions:

	<u>Quantity (Tons)</u>
Chromium Oxide	I 531
Cobalt	P 2614
Cobalt Oxide	E 923
Copper	PI 557611
Ferrochrome	I 22943
Ferromanganese	I 19721
Molybdenum Soluble Compounds	P 17677
Nickel	P 308042

05.03 Hazardous Substances Data Base Compilation

James F. MacLaren Limited
Environmental Consultants
Willowdale, Ontario

February 1976

05.03.01 References for Data Base Compilation

General References

- (A) James F. MacLaren Limited, "Hazardous Polluting Substances in the Lower Great Lakes" for Environment Canada, March 1974.
- (B) James F. MacLaren Limited, "Report on an Update of Hazardous Polluting Substances in the Lower Great Lakes", for Environment Canada, September 1975.
- (C) Statutes of Ontario, "The Environmental Protection Act, 1971", as amended by 1972, Chapter 1, s.69; 1972, Chapter 106; 1973 Chapter 94 and 1974, Chapter 20.
- (D) Revised Regulations of Ontario, "Regulation 15", as amended by O. Reg. 973/74.

References (cont'd.)

Data Base References

1. American Conference of Governmental Industrial Hygienists. "Documentation of the Threshold Limit Values for Substances in Workroom Air." Third Edition - 1971, Second Printing - 1974.
2. Bureau of National Affairs, Inc. "List of Toxic Substances". Occupational Safety and Health Reporter, 1971.
3. Sax, N.I., et al. "Dangerous Properties of Industrial Materials". Reinhold Book Corp., Third Edition, 1968.
4. National Institute for Occupational Safety and Health. "The Toxic Substances List, 1974 Edition." U.S. Department of Health, Education, and Welfare.
5. National Institute for Occupational Safety and Health, "Registry of Toxic Effects of Chemical Substances, 1975 Edition." U.S. Department of Health, Education and Welfare.
6. American Society for Testing and Materials. "Compilation of Odor and Taste Threshold Values Data - DS 48." 1975.
7. Hellman, T.M. and F.H. Small. "Characterization of the Odor Properties of 101 Petrochemicals Using Sensory Methods." Journal of the Air Pollution Control Association. Vol. 24, No. 10. October, 1974.
8. Litton Industries Incorporated. "Air Pollution Aspects of Odorous Compounds." U.S. Department of Health, Education, and Welfare. September, 1969.
9. Leonardos, G., D. Kendall and N. Barnard. "Odour Threshold Determinations of 53 Odorant Chemicals." Journal of the Air Pollution Control Association. Vol. 19, No. 2. February, 1969.
10. Manufacturing Chemists' Association. "Air Pollution Abatement Manual." Washington, D.C.
11. Hopton, F.J. "Odour - Its Nature and Measurement." Proceedings of 1974 Technical Seminar on The Fundamentals of Air Pollution Control. Sponsored by M.C.E. and P.C.A.O.
12. Davis, J.C. "Taking Malodors' Measure." Chemical Engineering. May 14, 1973.
13. Feldstein, M., D.A. Levaggi and R. Thuillier. "Odor Regulation by Emission Limitation at the Stack." Air Pollution Control Association - 66th Annual Meeting, 1974.

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14. Elliot, T.C. "Odors - More Nuisance than Health Threat."
Power. October, 1969.
15. Hawley, G.G., et al. "The Condensed Chemical Dictionary."
Van Nostrand Reinhold. Eight Edition, 1971.

05.03.02 Code Description

Physical Properties

- Col. No. 1 - Physical State
- Col. No. 2 - Vapour Pressure at Indicated Temperature
- Col. No. 3 - State Change and Temperature

TLV - TWA - CAR

- Col. No. 4 - TLV or TWA
- Col. No. 5 - TLV or TWA Unit Reference
- Col. No. 6 - Data Source Reference
- Co. No. 7 - Carcinogenic Indicator

Toxic Test Data

- Col. No. 8 - Dosage or Concentration
- Col. No. 9 - Unit Reference
- Col. No. 10 - Description of Exposure
- Col. No. 11 - Route of Exposure or Administration
- Col. No. 12 - Species Exposed
- Col. No. 13 - Data Source Reference

Odour Information

- Col. No. 14 - Type of Response
- Col. No. 15 - Threshold Concentration
- Col. No. 16 - Information Source Reference

Additional Information

- Col. No. 17 - Phytotoxicological Data Indicator
- Col. No. 18 - LD50 oral-Rat Test Data
- Col. No. 19 - Quantity Determination Code
- Col. No. 20 - Quantity Present

Physical Properties

- Col. No. 1 - Physical State

G - Gas
L - Liquid
S - Solid

cont'd

Code (cont'd)

Physical Properties (cont'd)

Col. No. 2 - Vapour Pressure at Indicated Temperature
(V.P. - °C)

V.P.: in mm (Hg) unless indicated by A
(atmospheres)

Temp = degrees C.

Col. No. 3 - State Change and Temperature
(°C - State Change)

B - boils
D - decomposes
E - explodes
F - flash point
I - ignites
M - melts
S - sublimes

TVA - TWA - CAR

Col. No. 4 - Threshold Limit Value or Time Weighted
Average

Col. No. 5 - TLV or TWA Unit Reference

Units for TLV - TWA are mg./m³ unless
indicated in this column

* = m.p.p.c.f.
X = fibres per ml.

Col. No. 6 - Data Source Reference

See list of references following this
section

Col. No. 7 - Carcinogenic Indicator

Indicates tests have shown carcinogenic
effects

Toxic Test Data

Col. No. 8 - Dosage or Concentration

Col. No. 9 - Unit Reference

Units for Col. No. 8 are mg./m³ unless
indicated in this column.

cont'd

Code (cont'd)

Toxic Test Data

(cont'd)

Col. No. 9

X = m.p.p.c.f.

P = p.p.m.

K = mg./kg. of body weight

Col. No. 10 - Description of Exposure

TDLO - toxic dose low

TCLO - toxic concentration low

LDLO - lethal dose low

LD50 - lethal dose fifty

LCLO - lethal concentration low

LC50 - lethal concentration fifty

Col. No. 11 - Route at Exposure or Administration

ICV - Intracervical

ITR - Intratracheal

IDR - Intradermal

IVG - Intravaginal

IDU - Intraduodenal

IVN - Intravenous

IHL - Inhalation

OCU - Ocular

IMP - Implant

ORL - Oral

IMS - Intramuscular

PAR - Parenteral

IPC - Intraplacental

REC - Rectal

IPL - Intrapleural

SKN - Skin

IPR - Intraperitoneal

SCU - Subcutaneous

IRN - Intrarenal

UNK - Unreported

Col. No. 12 - Species Exposed

BRD - bird (lab.)

INF - infant

BDW - wild bird

MAM - unspecified mammal

CAT - cat

MAN - man

CTL - cattle

MKY - monkey

CKN - chicken

MUS - mouse

CHD - child

PIG - pig

DOG - dog

PGN - pigeon

DOM - domestic animal

QAL - quail (lab.)

DCK - duck

EBT - rabbit

FRG - frog

RAT - rat

GRB - gerbil

SQL - squirrel

GPD - guinea pig

TOD - toad

HAM - hamster

TRK - turkey

HMN - human

WMN - woman

Col. No. 13 - Data Source Reference

See list of references following this section.

cont'd

Code (cont'd)

Odour Information

Col. No. 14 - Type of response

D = detection
R = recognition
U = implies unspecified

Col. No. 15 - Response Concentration (mg./m³)

Col. No. 16 - Information Source Reference

See list of references following this section

Additional Information

Col. No. 17 - Phytotoxicological Data Indicator

P - indicates phytotoxicological data included

Col. No. 18 - LD50 ORAL-RAT Test Data

Col. No. 19 - Quantity Determination Code

AS - shipped
E - exported
EU - exported plus used
I - imported
P - produced
PI - produced plus imported
S - sales
U - used

Col. No. 20 - Quantity Present (tons)

05.03.03

Data Base Table

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT					QUANTITY			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ABS RESINS	S																			
ACETALDEHYDE	L	740-20	20.2-5	180	1				245	-	TCL0-IHL-HMN-4	D-	0.12-	8					U-	43560
ACETAMIDE	S	1-65	223-3						360	-	K-TCL0-CRL-RAT-4									
ACETANILIDE	S	1-114	303.8-8						800	-	K-LD50-CRL-RAT-4							800		
ACETIC ACID	L	11.4-20	113.1-8	25	1				2040	-	TCL0-IHL-HMN-4	D-	2.45-	6					U-	16155
ACETIC ANHYDRIDE	L	10-35	133.9-8	20	1				4250	-	LCL0-IHL-RAT-4	U-	1.50-	7						
ACETOBROMOGALACTOSE																				
ACETOBROMOGLUCOSE																				
ACETOBROMOINULOSE																				
ACETONE	L	400-39.5	55.2-5	2400	1				1200	-	TCL0-IHL-HMN-4	U-	77.10-	7					U-	4335
ACETONE CYANOHYDRIN	L		82-8						220	-	LCL0-IHL-RAT-4									
ACETONITRILE	L		82-8	70	1				12650	-	LCL0-IHL-RAT-4								I-	205
ACETOPHENETINE	S		136-8						1000	-	K-TCL0-CRL-HMN-4									
ACETOPHENONE	L	1-15	202.3-8						3000	-	K-LD50-CRL-RAT-4	U-	2.95-	7				3600		
P-ACETYLAMINO-FLUORENE	S		194-M	CAR	1	C			580	-	K-LDLO-CRL-RAT-4									
ACETYL BROMIDE	L		73.7-2																	
ACETYL CHLORIDE	L		51-8																	
N-ACETYL-L-CYSTEINE																				
ACETYLENE	G	40A-16	4.4-8						400	-	K-LFLU-IPR-MUS-4									
ACETYLENE BLACK (SEE CARBON BLACK)				3.5	1				120	-	K-LD50-IVN-RAT-4								U-	43000
ACETYL PHENYL-HYDRAZINE																			U-	86280
ACIPICINE	S	1-129.4	546-8						500	-	K-LD50-CRL-MUS-4									
ACROLEIN (SEE HERBICIDES)	L		52.5-8	0.25	1				1.6	-	TCL0-IHL-HMN-4	R-	0.40-	6						
ACRYLAMIDE	S	1.6-84.5	84.5-M	0.30	1				126	-	K-LDLO-CRL-RAT-4								U-	60
ACRYLIC ACID	L	10-39	141-3						15000	-	LCL0-IHL-RAT-4	U-	3.10-	7					I-	12360
ACRYLIC RESINS																			I-	15920
ACRYLONITRILE	L	100-22.8	77.3-8	45	1				570	-	LCL0-IHL-RAT-4	U-	3.40-	8					I-	1845
ACRYLONITRILE-BUTADIENE RESINS																			I-	6130
ADIPIC ACID																				
ADIPIC ACID	S	1-159.5	152-M						1900	-	K-LD50-CRL-MUS-4								U-	390
ADIPONITRILE	L		835-8						40	-	K-LDLO-IPR-MUS-4									
ALCOL	L		182-8						140	-	K-LD50-SKI-RAT-4									
ALKYD RESINS																				
ALKYL ARYL BROMIDE																			U-	25150
ALKYLDIMETHYLBENZYLAMMONIUM CHLORIDE	L																			
ALKYLTETRAETHYLBENZYLAMMONIUM CHLORIDE									30	-	K-LD50-CRL-FRG-4									
ALLYL ALCOHOL (SEE FUNGICIDES)	L	10-10.5	96-8	5	1				60	-	TCL0-IHL-HMN-4	D-	3.30-	6						
ALLYL CHLORIDE	L		44.6-8	3	1				6370	-	LCL0-IHL-RAT-4	U-	1.50-	9						
ALLYL GLYCIDYL ETHER				22	1				922	-	K-LD50-CRL-RAT-4								922	
ALLYL PROPYL DISULPHIDE	L			12	1				18.5	-	TCL0-IHL-HMN-4									
ALUM CAKE (SEE ALUMINUM SULPHATE)	S		770-0						4.2	-	K-L750-CAL-MUS-4									
ALUMINUM	S	1-1284	660-7																	U-126820
ALUMINUM ACETATE	S																		PIJ115341	
ALUMINUM AMMONIA SULPHATE	S		97.6-M																	
ALUMINUM CHLORIDE	S	1-100	180.2-S						3.8	-	K-LD50-CRL-MUS-4								U-	850
ALUMINUM FLUORIDE	S	1-1238	1040-M																	
ALUMINUM FORMATE, BASIC	S																			
ALUMINUM HYDROXIDE	S																			
ALUMINUM NITRATE	S		150-D						4280	-	K-LD50-CRL-RAT-4								4280	
ALUMINUM OLEATE	L																			
ALUMINUM OXIDE	S	1-2158	2050-M	30	1				357	-	TCL0-IHL-MUS-4									
ALUMINUM POTASSIUM SULPHATE																				
ALUMINUM SILICATE	S																			

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							ODOUR-INFO PHY O-RAT QUANTITY						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ALUMINUM STEARATE	S																			
ALUMINUM SULPHATE	S		770-D																	U- 50
P-AMINODIETHYLANILINE HCL																				U-126820
P-AMINODIMETHYLANILINE	S		150-B																	
P-AMINODIMETHYLANILINE HCL																				935
N-AMINOETHYL-4-HYDROXYETHYL OLEAMIDE																				
N-AMINOETHYL-4-HYDROXYETHYL STEARAMIDE																				
2-AMINO-2-METHYL-L-PROPANOL HYDROCHLORIDE																				
P-AMINOPHENOL	S		264-D	CAR			1 C													1270
1-(3-AMINO-PROPYL)ROSINAMINE DIACETATE																				
2-AMINOPYRIMINE	S		210-A-M				2													
2-AMINOTHIAZOLE	S		94-M																	
2-AMINO-1,3,4-THIADIAZOLE																				
4-AMINO-2-TOLUENE SULPHONIC ACID																				
AMMONIA	G	10A-26	-30-B	18			1													
AMMONIUM ACETATE																				PIU353147
AMMONIUM ALGinate																				
AMMONIUM BICARBONATE	S		40-D																	
AMMONIUM BIFLUORIDE	S																			
AMMONIUM BISULPHIDE	S		-D																	
AMMONIUM BISULPHITE			-D																	
AMMONIUM BOROFLUORIDE																				
AMMONIUM BROMIDE	S	1-198	394-B																	
AMMONIUM CARBAMATE	S		61-S																	
AMMONIUM CARBONATE	S																			
AMMONIUM CHLORIDE	S	1-160	337-C-B	10			1													
AMMONIUM CHLOROPLATINATE	S		-D	4.6			4													1650 U- 1640
AMMONIUM CITRATE	S		-D																	
AMMONIUM DICARBONATE	S		-D																	
AMMONIUM DODECYLBENZENESULPHONATE																				
AMMONIUM FLUORIDE	S		-S																	
AMMONIUM HYDROXIDE	L		77-M																	
AMMONIUM LACTATE																				350
AMMONIUM LAUREYL ETHER SULPHATE																				
AMMONIUM LAUREYL SULPHATE																				
AMMONIUM LIGNOSULPHONATES																				
AMMONIUM NITRATES	S		210-D																	UE-776616
AMMONIUM NITRATE SULPHATE																				
AMMONIUM OXALATE	S																			
AMMONIUM PERCHLORATE	S		-D																	
AMMONIUM PERSULPHATE	S		120-D																	
AMMONIUM PICRATE	S		-D																	820
AMMONIUM PHOSPHATES	S																			
AMMONIUM PHOSPHATE, DIBASIC	S																			P-915617
AMMONIUM PHOSPHATE, MONOBASIC	S																			
AMMONIUM SALTS	S																			
AMMONIUM SILICO FLUORIDE	S		-S																	
AMMONIUM STEARATE	S																			
AMMONIUM SULPHATE	S		-D																	
AMMONIUM SULPHIDE	S		-D																	PI-383128
AMMONIUM SULPHITE	S		150-S																	
AMMONIUM TARTRATE																				
AMMONIUM THIOCYANATE	S		170-D																	
				</																

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						OCCUP-INFO PHY O-RAT QUANTITY							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AMMONIUM TOLUENE SULPHONATE	S																			
AMMONIUM XYLENE SULPHONATE																				
S-AMYL ACETATE	L		120-B	650	1			50000 -	LCLO-IHL-GPG-4											
N-AMYL ACETATE	L		148-B	525	1			1000 -	TCLO-IHL-HMN-4	0-	0.50-	6								
N-AMYL ALCOHOL	L	1-13.6	138-B					1390-K-	LDLO-ORL-GPG-4	U-	3.60-	7								
N-AMYL ALCOHOL	L	10-17.2	102-B					1000-K-	LD50-ORL-RAT-4									1000		
AMYL CHLORIDE	L		108-B																	
AMYLITROSONITROGUANIDINE																				
ANILINE	L	1-34.8	184-B	19	1			975 -	LCLO-IHL-RAT-4	U-	0.90-	10								
ANILINE HYPOCHLORIDE	S		198-M					P41-K-	LD50-ORL-PUS-4											
ANISIC ALDEHYDE	S		38-M					1260-K-	LD50-ORL-GPG-4											
ANISIDINE	L		22.5-B	0.5	1			1.9 -	TCLO-IHL-HMN-4											
P-ANISYLCHLORODIPHENYLMETHANE																				
ANTHRACENE	S	1-145	217-B																	
ANTIMONY AND COMPOUNDS	S	1-886	630-M	0.5	1			4.7 -	TXCO-IHL-MAN-2											
ANTIMONY OXIDE (SEE ANTIMONY TRIOXIDE)	S	1-574	655-M	1.32	4			4000-K-	LDLO-IPR-RAT-4										I-	422
ANTIMONY PENTACHLORIDE	L	1-22.7	145-B	1.22	4			675-K-	LD50-ORL-RAT-4									675		
ANTIMONY PENTAFLOURIDE	L		145-B																	
ANTIMONY PENTASULPHIDE	S		-D	1.65	4			1500-K-	LD50-IPR-RAT-4											
ANTIMONY POTASSIUM TARTRATE	S			0.5	4			2-K-	LDLO-ORL-HMN-4										I-	20
ANTIMONY SULPHATE	S		-D					1000-K-	LDLO-IPR-RAT-4											
ANTIMONY SULPHIDE	S		550-M	1.4	4			565 -	LCLO-IHL-HMN-4											
ANTIMONY TRICHLORIDE	S		73.4-M	0.93	4			131 -	TCLO-IHL-HMN-4											
ANTIMONY TRIETHYL (SEE TRIETHYLSTIBINE)	L	1-49.2	159.5-B																	
ANTIMONY TRIFLUORIDE	S		252-B																	
ANTIMONY TRIMETHYL (SEE TRIMETHYLSTIBINE)	L		80.5-B					1370-K-	LDLO-SCU-CAT-4											
ANTIMONY TRIOXIDE (SEE ANTIMONY OXIDE)	S	1-574	655-M	1.32	4			4000-K-	LDLO-IPR-RAT-4										I-	422
ATLANTA-4-PHENYL-THIOUREA)	S		198-M	0.3	1			6-K-	LD50-ORL-RAT-4									6		
2-ARABINOL DIACETATE																				
1-ARABINOSE																				
ARSENIC	G		-185-B																	
ARSENIC AND COMPOUNDS AS METAL	S	1-372	615-S	0.5	1			25-K-	LDLO-IHS-RAT-4										U-	140
ARSENIC DIETHYL	L		105-B																	
ARSENIC DIMETHYL	L		105-B																	
ARSENIC PENTASELENIDE	S																			
ARSENIC TRICHLORIDE	L	10-23.5	130-B					100 -	LCLO-IHL-CAT-4											
ARSENIC TRIOXIDE	S		193-S	0.05	4			0.11 -	TCLO-IHL-HMN-4										U-	265
ARSENITE																				
ARSENIC	G		-55-B	0.2	1			1.6 -	TCLO-IHL-HMN-4	U-	1.60-	3								
ASBESTOS	S			5	X	1														P1654000
ASCORBIC ACID	S		192-M					88-K-	LD50-IPR-RAT-4											
ASPHALT (PETROLEUM) FUMES	G		47-B	5	1															
1-AZA-3,7-DIOXA-5-HYDROXYBETHYLBICYCLO (33,0)OCTATE																				
AZELAIC ACID	S	1-178	103-M																I-	310
AZETIDINE																				
AZOETHANE																				
1,1-AZOISOBUTANE																				
2,2-AZOISOBUTANE																				
2,2-AZOBISOPROPANE																				
AZO ETHANE																				
AZOSULPHANIDE																				
9-BAPABICYCLO (3,3,1) NONANE																				
BARITE (SEE BARIUM SULPHATE)	S		1580-K																	

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						OCCUR-INFO PHY O-RAT QUANTITY							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BARIUM AND COMPOUNDS	S	10-1049	350-M	0.5	1															
BARIUM ACETATE	S			0.93	4			236-K-LDLO-ORL-RST-4												
BARIUM CARBONATE	S		1740-B					630-K-LDLO-CRL-RAT-4											I- 3600	
BARIUM CHLORIDE	S		1560-B	0.01	4			80-K-LDLO-ORL-RAT-4											U- 485	
BARIUM CYANIDE	S																			
BARIUM 2-ETHYLHEXOATE																				
BARIUM FERRITE																				
BARIUM FLUORIDE	S		1280-M					350-K-LDLO-ORL-GPG-4												
BARIUM NAPHTHENATE								355-K-LD50-CRL-RAT-4									355			
BARIUM NITRATE	S		592-M	0.95	4															
BARIUM NONYL PHENATE																				
BARIUM OXALATE	S																			
BARIUM STEARATE	S																			
BARIUM STYPMATE																				
BARIUM SULPHATE (SEE BARITE)	S		1580-M																	
BARIUM SULPHIDE	S																			
BARIUM TRINITROPHLOROGUCINATE																				
BAUXITE (SEE ALUMINUM SULPHATE)	S		770-D																	
BENZANILIDE																				
BENZENE	L	100-26.1	80-B	32	4			660 - TCLO-IHL-4MN-4	U- 1.30-10										PI-300838	
BENZENE BORONIC ACID								740-K-LD50-CRL-RAT-4											740	
BENZENE HEXACHLORIDE	S	0.03-20	157-M	0.5	3			1700-K-LD50-CRL-CAT-4												
BENZENE SULPHONATE																				
BENZENE-SULPHONIC ACID	S		40-B					75-K-LD50-CRL-RND-4												
BENZIDINE	S		120-M	CAR	1	C		214-K-LD50-CRL-RUS-4												
BENZOIC ACID	S	1-96	121-M					2370-K-LD50-CRL-RUS-4											I- 455	
BENZONITRILE	L	1-20.2	220-B					180-K-LDLO-SCU-RUS-4												
2-BE ZOYL-1,3-DICHLOROPROPANE																				
BENZYL PEROXIDE, DRY	S		100-M	S	1			12 - TCLO-IHL-4MN-4												
BENZYL CHLORIDE	L			S	1			65 - TCLO-IHL-4MN-4	D- 0.21-10											
3-BENZYL-5,5-DIMETHYL-2-IMIDAZOLINETHIONE																				
4-BENZYLISOTHIAZOLE																				
BENZYL-TRIALKYL AMMONIUM CHLORIDE	L		135-M																	
BENZYL-TRIMETHYL AMMONIUM CHLORIDE	S																			
BERYLLIUM	S		1270-M	.002	1			0.1 - TCLO-IHL-4MN-4											U- 0.3	
BERYLLIUM CARBONATE	S			.002	4			50-K-LD50-IPR-GPG-4												
BERYLLIUM CHLORIDE	S	1-291	440-M	.002	4			86-K-LD50-CPL-RAT-4											86	
BERYLLIUM HYDROXIDE	S		130-D	.002	4			0.8-K-LD50-IVL-RAT-4												
BERYLLIUM NITRATE	S		60-M	.002	4			501-K-LD50-IPR-RAT-4												
BERYLLIUM OXIDE	S		2500-M	.002	4			54-K-TDLO-IPR-RAT-4												
BERYLLIUM SELENATE	S																			
BERYLLIUM SULPHATE	S		550-M	.002	4			1.8-K-LD50-IVL-RAT-4												
BISACRYL																				
BIS-BENZYL ETHYLENE DIAMINE DIACETATE																				
BIS(P-CHLOROPHENOXY) METHANE	S		70-M																	
N,N'-BIS(1,4-CINETHYL PENTYL)-P-PHENYLENE DIAMINE																				
BIS(ETHYL AND SALTS	S	1-1021	271-M																P- 286	
BIS(ETHYL TELLURIDE	S		572-M	10	1															
BISPHENOL-A	S			2.8	1			1900 - LCLO-IHL-RST-4												
BIS(TRI-N-BUTYL TIN)OXIDE								194-K-LD50-CRL-RAT-4											194	
BOM (ALSO 8-OXYNAPHTHOIC ACID)																				
BORIC ACID	S		185-D					640-K-LDLO-CRL-RAT-4											U- 30	
																			I- 450	

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						OCCUR-INFO PHY O-RAT QUANTITY							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BORON	S		2300-4						2000-K-LD50-ORL-RAT-4											
BORON CARBIDE	S		2450-M																	
BORON OXIDE	S		450-M			10	1													
BORON TRIBORIDE	L	40-14	91.7-3		10	1														
BORON TRICHLORIDE	L	1-12.7	12.5-3						100 - LCL0-IHL-RAT-4											
BORON TRIFLUORIDE	G		-110.7-B		3	1			109 - LC50-IHL-SPG-4											
BROMIC ACID	L		100-0						1200 - LCL0-IHL-RAT-4											
BROMINE	L	175-21	58.7-R		0.7	1														
BROMINE PENTAFLUORIDE	L		40.5-B		0.7	1									R-	0.31-	6			
P-BROMO ANISOLE																				
3-BROMO-2,6-DINITROBENZANILIDE																				
4-BROMO-2,6-DINITROBENZANILIDE																				
BROMOPROPANE (ALSO TRIBROMOETHANE)	L		149.5-B		5	1			1820-K-LD50-SCU-MUS-4	U-	5480-	8								
4-BROMO-2-NITROBENZANILIDE																				
2-BROMO-4-NITROPHENOL																				
3-BROMO-4-NITROPHENOL																				
2-BROMO-4-NITROPHENOL (NA SALT)																				
2-BROMO-3-NITROSALICYLANILIDE																				
3-BROMO-4-NITROSALICYLANILIDE																				
4-BROMO-3-NITROSALICYLANILIDE																				
4-BROMO-5-NITROSALICYLANILIDE																				
4-BROMO-3-NITRO-0-SALICYLOTCLUIDIDE																				
1,2-BUTADIENE																				
1,3-BUTADIENE	G	1840-21	-4.5-B	2200		1			285-K-LC50-IHL-RAT-2	U-	2,40-	7							I-	1670
BUTADIENE-STYRENE RESINS																				
BUTANE	G	2A-18.8	-0.5-B	1200		1			658 - LC50-IHL-RAT-4	U-	14,30-	11							P-	104200
2-BUTANONE (SEE METHYL ETHYL KETONE)	L	71.2-20	79-3	590		1			6000 - LCL0-IHL-RAT-4	R-	29,50-	6							U-	1080
BUTENE-1	G	3480-21	-6.3-B																	
2-BUTOXY ETHANOL	L	0.6-20	171.2-B	240		1			1480-K-LD50-ORL-RAT-4										1480	
N-BUTYL ACETATE	L	15-25	126-R	700		1			960 - TCLO-IHL-RAT-4	U-	0.20-	7							U-	1485
S-BUTYL ACETATE	L		112-B	950		1			950 - TCLO-IHL-RAT-4											
T-BUTYL ACETATE	L		96-B	950		1			950 - TCLO-IHL-RAT-4											
BUTYL ACETYL RICINOLEATE	L		220-F																	
N-BUTYL ACRYLATE	L	10-35.5	69-B						5325 - LCL0-IHL-RAT-4										U-	215
N-BUTYL ALCOHOL	L	5.5-20	117.5-B	300		1			77 - TCLO-IHL-RAT-4	D-	0.20-	6							U-	5590
S-BUTYL ALCOHOL	L	10-20	99.5-B	450		1			771-K-LD50-IPR-MUS-4											
T-BUTYL ALCOHOL	L	40-24.5	82.6-B	300		1			6000-K-LCL0-ORL-RAT-4	U-	1.20-	7							U-	310
C-BUTYLAMINE	L		77-B	15		1			500-K-LD50-ORL-RAT-4	U-	0.72-	7							500	
BUTYLATED HYDROXYTOLUENE									947-K-LDLO-ORL-CAT-4											
S-BUTYL BENZENE	L	1-18.6	173.5-B						2240-K-LD50-ORL-RAT-4										2240	
T-BUTYL BENZENE	L	1-22.7	182.1-B																	
T-BUTYL CHROMATE					0.1	1														
BUTYL DECYL PHTHALATE																				
BUTYLENES																			I-	2970
BUTYL-2-ETHYLHEXYL PHTHALATE																				
N-BUTYL GLYCIDYL ETHER					270	1			2050-K-LD50-ORL-RAT-4										2050	
T-BUTYL HYDROPEROXIDE	L								1500-K-LD50-ORL-RAT-4										1500	
BUTYL ISOOCTYL PHTHALATE																				
BUTYL LACTATE	L	0.4-20	188-B	25		1			200-K-LDLO-IPR-RAT-4											
BUTYL LITHIUM																				
BUTYL MERCAPTION CHLORIDE	L																			
BUTYL MERCAPTAN	L		99-B	2		1			10 - TCLO-IHL-RAT-4	D-	3,0026-	8								
BUTYL METHACRYLATE	L		163-B						255-K-LDLO-IPR-MUS-4										U-	265
BUTYL NITROSODITROGUANIDINE																				

	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						ODOUR-INFO PHY O-RAT QUANTITY							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	BUTYL OLEATE	L		173-B																	
2	T-BUTYL PEROBENZOATE	L	0.33-50						4160-K-LDLO-OGL-RAT-4												
3	P-T-BUTYL PHENOL	L	1-70	238-B					2520-P-LD50-SKN-RBT-4												
4	N-SEC-BUTYL-N-PHENYL-PARA-PHENYLENEDIAMINE																				
5	BUTYL RICINOLEATE	L		275-B																	
6	BUTYL RUBBER																				
7	BUTYL STEARATE	L		220-B																	
8	BUTYL TIN COMPOUNDS																				
9	P-BUTYLTOLUENE	L			60	1			1500-K-LD50-OGL-RAT-4							1500					
10	BUTYL XANTHATES																				
11	BUTYRALDEHYDE	L		75.7-B					2490-K-LD50-OGL-RAT-4	U-	0.03-10					2490					
12	BUTYRALDEHYDE-ANILINE	L																			
13	BUTYRALDOXIME	L		152-B					200-K-LDLO-IPR-MUS-4									U-	20		
14	BUTYRIC ACID	S	0.43-20	163.5-B					2940-K-LD50-OGL-RAT-4	U-	0.0036-10					2940					
15	CACODYLIC ACID	S		200-M					1350-K-LD50-OPL-RAT-4							1350					
16	CADMIUM AND COMPOUNDS	S	1-394	321-X	0.1	1			15-K-LDLO-IHS-RAT-4									P-	926		
17	CADMIUM BENZOATE	S																			
18	CADMIUM CHLORIDE	S	10-656	560-M					8 - LC50-IHL-DDG-4												
19	CADMIUM CYANIDE	S		200-F																	
20	CADMIUM 2-ETHYLHEXOATE																				
21	CADMIUM FLUORIDE	S	1-1112	1100-M					150-K-LD50-OGL-SPG-4												
22	CADMIUM NITRATE	S		350-M																	
23	CADMIUM SULFIDE	S	1-1000	9000-M	0.05	1			9 - TCLLO-IHL-HMN-4									U-	5		
24	CADMIUM PHOSPHATE	S		1500-M					650 - LCLLO-IHL-MUS-4												
25	CADMIUM POTASSIUM CYANIDE	S																			
26	CADMIUM SELENIDE	S		1350-M														U-	5		
27	CADMIUM SULPHATE	S		1000-M					2-K-LDLO-SCU-RAT-4									U-	5		
28	CADMIUM SULPHIDE	S		1750-M					90-K-LDLO-SCU-RAT-4									U-	5		
29	CADMIUM SULFOSELENIDES																	U-	5		
30	CAFFEINE	S		236.8-M					1500-K-TDLO-OGL-RAT-4												
31	CALCIUM	S	10-983	542-B														P-	200		
32	CALCIUM ACETATE	S							52-K-LD50-IVN-MUS-4												
33	CALCIUM ALGINATE	S																			
34	CALCIUM ARSENATE	S			1	1			753-K-TDLO-UNK-HMR-4												
35	CALCIUM ARSENITE	S																			
36	CALCIUM CARBIDE	S		2300-M														U-	9420		
37	CALCIUM CARBONATE	S		825-M														U-	56655		
38	CALCIUM CASEINATE																				
39	CALCIUM CHLORIDE	S		772-M					1000-K-LD50-OGL-RAT-4							1000		I-	16365		
40	CALCIUM CITRATE	S																P-	8885		
41	CALCIUM CYANIDE	S		1300-M					1400-K-LD50-OGL-RBT-4									UE-	132765		
42	CALCIUM CYANIDE	S		350-D					39-K-LD50-OGL-RAT-4							39					
43	CALCIUM DISODIUM ETHYLENEDIAMINETETRA ACETATE	S							3200-K-LD50-IPR-RAT-4												
44	CALCIUM DISULPHIDE																				
45	CALCIUM DODECYLBENZENE SULPHONATE																				
46	CALCIUM 2-ETHYLHEXOATE																				
47	CALCIUM FLUORIDE	S																			
48	CALCIUM HYDRIIDE	S		1360-M																	
49	CALCIUM HYDROXIDE	S		600-D																	
50	CALCIUM HYPOCHLORITE	S																			
51	CALCIUM IODATE	S		-D															I-	2560	
52	CALCIUM IODINE																				
53	CALCIUM ISODECAOATE																				
54	CALCIUM LIGNOSULPHONATES																				

[illegible]

COMPOUND NAME	PHYSICAL-PROPERTIES							TLV-TWA-CAR	TOXIC-TEST-DATA										OCCUR-INFO PHY O-RAT QUANTITY				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
CHLORINATED BIPHENYL OXIDE				0.5	1															U- 280			
CHLORINATED PARAFFINS																				PI-849926			
CHLORINATED TRISODIUM PHOSPHATE																				U- 25			
CHLORINE	G	4800-20	-34.5-B	3	1			44 - TCLD-IHL-HMN-4	R-	0.91- 6													
CHLORINE DIOXIDE	G		9.9-B	0.3	1			53 - TCLD-IHL-HMN-4															
CHLORINE TRIFLUORIDE	G		11.8-B	0.4	1			265 - LCSO-IHL-RAT-4															
CHLORACETALDEHYDE	L	100-45	95-B	3	1			23-K-LD50-ORL-RAT-4											23				
3-CHLORO-5-ACETAMINOSALICYLANILIDE																							
CHLOROACETOPHENONE	S	.012-0	56-B	0.3	1			119 - TCLD-IHL-HMN-4	U-	0.10- 6													
CHLORANILINE				0.22	1			256-K-LD50-ORL-MUS-4															
p-CHLOROBENZANILIDE																							
CHLOROPRENE	L	10-22.2	131.7-B	350	1			2910-K-LD50-ORL-RAT-4	R-	1.00- 6								2910	I-	2580			
CHLOROPRENE								6900 - LCSO-IHL-HMN-4															
CHLOROPRENE MALONONITRILE	S		317-B	0.4	1			176-K-LD50-ORL-RAT-4											178				
CHLOROPROPYLENE	L		67.0-B	1050	1			4300-K-LD50-ORL-MUS-4															
4-CHLORO-5-BROMO-3-NITROSALICYLANILIDE																							
CHLOROPRENE	G		-40.2-B	3500	1																		
CHLORODIBROMOMETHANE																							
1-CHLORO-2,6-DIHYDROXY BIPHENYL SULFONE																							
4-CHLORO-2,6-DIHYDROXY-3-NITROSALICYLANILIDE																							
2-CHLORO-3,5-DINITROBENZANILIDE																							
3-CHLORO-3,5-DINITROBENZANILIDE																							
4-CHLORO-3,5-DINITROBENZANILIDE																							
2-CHLORO-3,5-DINITRO-4-FLUOROTOLUIDIDE																							
3-CHLORO-3,5-DINITRO-4-FLUOROTOLUIDIDE																							
4-CHLORO-3,5-DINITRO-4-FLUOROTOLUIDIDE																							
2-CHLORO-3,4-DINITROSALICYLANILIDE																							
CHLOROPRENE	L	100-10.4	61.2-B	125	1			50 - TCLD-IHL-HMN-4	D-	3320- 6									I	1660			
4-CHLORO-2,6-DIHYDROXY BIPHENYL SULFONE																							
CHLORODIPHENYL	L		350-B	0.5	1			500-K-LD50-ORL-RAT-4											500				
3-CHLORO-3-HYDROXYBENZANILIDE																							
4-CHLORO-3-HYDROXYBENZANILIDE																							
CHLORODIMETHYL METHYL ETHER																							
2-CHLORO-3-METHYL-3-NITRO SALICYLANILIDE																							
2-CHLORO-2-METHYL PROPANE																							
3-CHLORO-2-NITROBENZANILIDE																							
2-CHLORO-3-NITROBENZANILIDE																							
2-CHLORO-4-NITROBENZANILIDE																							
3-CHLORO-2-NITROBENZANILIDE																							
3-CHLORO-3-NITROBENZANILIDE																							
2-CHLORO-4-NITROBENZANILIDE																							
4-CHLORO-2-NITROBENZANILIDE																							
5-CHLORO-4-NITROBENZANILIDE																							
3-CHLORO-2-NITRO-4-FLUOROTOLUIDIDE																							
2-CHLORO-3-NITRO-4-FLUOROTOLUIDIDE																							
5-CHLORO-2-NITROBENZOL																							
CHLORONITROPROPANE (SEE KOTAX)	L		139.5-B	100	1			362-K-LD50-SKN-RAT-4															
5-CHLORO-3-NITRO-2-SALICYLANILIDE																							
2-CHLORO-3-NITROSALICYLANILIDE																							
2-CHLORO-5-NITROSALICYLANILIDE																							
2-CHLORO-3-NITROSALICYLANILIDE																							

[illegible]

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT QUANTITY									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
COBALT ISODECANOATE																					
COBALT LTHIOLEATE																					
COBALT NAPHTHENATE	S								3900-K-LD50-ORL-RAT-4									3900			
COBALT NECDECANOATE																					
COBALT NITRATE	S		100-M						400-K-LDLO-ORL-RBT-4												
COBALT OXIDES	S		1800-M						1700-K-LD50-ORL-RAT-4									1700	E-	923	
COBALT TALLATE																					
COCONUT FATTY ACID																					
COCONUT OIL	L		20-M																U-	125	
COD OIL	L																		PI-	38974	
COPPER DUST AND MIST	S	1-1628	1083-M	1.0		1													U-	310	
COPPER FUME	S	1-1628	1083-M	0.2		1			1.0 - TDLO-IHL-4MN-4										PI-	557611	
COPPER ACETOARSENITE	S								22-K-LD50-ORL-RAT-4											22	
COPPER CARBONATE	S		200-D	1.0		4			159-K-LD50-ORL-RAT-4											159	
COPPER CHLORIDE	S		490-M	1.0		4			140-K-LD50-ORL-RAT-4											140	
COPPER CITRATE (SEE CUPRIC CITRATE)	S																				
COPPER CYANIDE	S		-D						50-K-LDLO-IPR-RAT-4												
COPPER DISODIUM VERSEANATE																					
COPPER 2-ETHYHEXOATE																					
COPPER 8-HYDROXYQUINOLINE	S		210-D																		
COPPER NAPHTHENATE	S																				
COPPER NITRATE	S		114.5-M																		
COPPER OLEATE	S																				
COPPER OXIDE BLACK	S		1026-D																		
COPPER OXIDE RED	S		1235-M																I-	105	
COPPER PARAAINO BENZOATE																			I-	105	
COPPER 8-SULFOLINOLATE	S		210-D																		
COPPER SALICYLATE																					
COPPER S.LTS																					
COPPER SODIUM CITRATE																					
COPPER SULPHATE (SEE CUPRIC SULPHATE)	S			1.0		4			300-K-LD50-ORL-RAT-4									300	I-	2270	
COPPER TALLATE (SOAP)																					
COPPER TARTRATE																					
CORN OIL FATTY ACID																					
CORN OIL	L		390-I																	PI-	21779
COTTON DUST				0.2		1			10000 - TCLO-IHL-4MN-4												
CRESOTE	L		200-M						600-K-LDLO-ORL-RBT-4						U- 0.031- 8						
CRESOLS	L	1-38.5	151-B	22		1			1000-K-LDLO-SKN-MUS-4										I-	685	
O-CRESOL	L	1-38.2	190-B	22		1			1380-K-LD50-SKN-RBT-4						U- 1.15- 8						
P-CRESOL	L	1-53.0	201-B	22		1			301-K-LD50-SKN-RBT-4						R- 0.004- 6						
CROTONALDEHYDE	L		104-B						12 - TCLO-IHL-4MN-4						U- 0.18-10						
CRUICATE (ALSO RUELENE)									660-K-LD50-ORL-RAT-4										660		
CRYOLITE	S		1000-M	4.6		4			9-K-LDLO-ORL-RBT-4										I-	2478	
CRYSTAL VIOLET									125-K-LDLO-ORL-RBT-4												
CUMENE	L	10-38.3	152-B	250		1			7000 - LCLO-IHL-MUS-4						U- 0.23- 7						
CUMENE HYDROPEROXIDE	L		153-B						1260 - LC50-IHL-RAT-4												
CUPRIC ACETATE	S		115-B																		
CUPRIC AMMONIUM CHLORIDE																					
CUPRIC CHLORIDE	S		490-M																		
CUPRIC CITRATE (SEE COPPER CITRATE)	S																				
CUPRIC DICHLORIDE	S																				
CUPRIC NITRATE	S		114.5-M																		
CUPRIC SALICYLATE	S																				
CUPRIC SULPHATE (SEE COPPER SULPHATE)	S			1.0		4			300-K-LD50-ORL-RAT-4									300	I-	2270	

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	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							DOOSUR-INFO PHY O-RAT QUANTITY						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	DIPHENYL	S		70-M	1	1		2180-K-LD50-ORL-RAT-4												2180	
2	DIPHENYLAMINE	S	1-108.3	52.9-M	10	1															
3	DIPHENYL MERCURY DODECENYL SUCCINATE																				
4	N,N'-DIPHENYL-PARA-PHENYLENEDIAMINE	S																			
5	DI-N-PROPYLAMINE	L		105-B											U- 0.41- 7						
6	DIPROPYLENE GLYCOL	L	1-73.6	231.8-B															U-	60	
7	DISALICYLAOPROPLENEDIIMINE	L		-23.3-B																	
8	DISOXIUM DIHYDROXY ETHYL GLYCINE																				
9	DISOXIUM ETHYLENE BISDITHIOCARBAMATE	S						395-K-LD50-ORL-RAT-4												395	
10	DISOXIUM NITRILCTRIACETATE							1460-K-LD50-ORL-RAT-4												1460	
11	DISOXIUM OCTOBRATE TETRAHYDRATE																				
12	DITHIAZALE IODIDE																				
13	DITRIDECYL PHTHALATE			285-B																	
14	DIVINYLBENZENE	L	1-32.7	199.5-B																	
15	DODECYLACETANIDIO-DIMETHYL BENZYLAMMONIUM CHLORIDE							2000-K-LD50-ORL-RAT-4												2000	
16	DODECELESTIC ACID																				
17	DODECYLBENZENE	L		290-B																	
18	DODECYLBENZENE SULPHONIC ACID																				
19	6-DODECYL-1,2-DIHYDRO-2,2,4-TRIMETHYLQUINOLINE																				
20	DODECYL MERCAPTAN	L		115-B																	
21	DODECYL PHENOL	L		154-B				2140-K-LD50-ORL-RAT-4												2140	
22	DRIPOLENE																				
23	EUPHON (SEE I SECTIONICES)				0.1	1		3-K-LD50-ORL-RAT-4												3	
24	EPICHLOROHYDRIN	L	10-16.6	117.9-B	19	1		18.5 - TCLO-IHL-HNN-4													
25	ETHANE	G		-82.6-B																	
26	ETHANOL (SEE ETHYL ALCOHOL)	L	40-19	78.3-B	1900	1		50-K-LDLO-ORL-HNN-4	U-	3.60-10									U-	12765	
27	ETHANOLAMINES	L	6-60	170.5-B	6	1													AS-	9648	
28	6-ETHOXY-1,2-DIHYDRO-2,2,4-TRIMETHYLQUINOLINE	L		125-B				800-K-LD50-ORL-RAT-4												800	
29	ETHOXY TRIGLYCOL		0.01-20																		
30	ETHYL ACETATE				1400	1		5865 - LC50-IHL-RAT-4	D-	6.00- 6									U-	98160	
31	ETHYL ACRYLATE				100	1		5000 - LCLO-IHL-RAT-4	R-	0.012- 7									U-	730	
32	ETHYL ALCOHOL (SEE ETHANOL)	L	40-19	78.3-B	1900	1		50-K-LDLO-ORL-HNN-4		3.60-10									U-	12765	
33	ETHYL ALUMINUM SESQUICHLORIDE	L																			
34	ETHYL AMINE	L	400-2	16.6-B	18	1		5600 - LCLO-IHL-RAT-4	U-	1.53- 7											
35	ETHYL AMYL KETONE	L		180-B	130	1		2800-K-LD50-ORL-RAT-4												2800	
36	ETHYL BENZENE	L	10-25.9	126-B	435	1		880 - TCLO-CCU-HNN-4													
37	ETHYL BROMIDE	L	400-21	38.4-B	890	1		9800 - LCLO-IHL-GPG-4													
38	ETHYL BUTYL KETONE	L		142-B	230	1		2760-K-LD50-ORL-RAT-4												2760	
39	ETHYL CHLORIDE	L	1000-20	12.3-B	2600	1		34500 - TCLO-IHL-HNN-4											U-	13455	
40	ETHYLENE CHLOROHYDRIN	L	10-30	120-B	16	1		71-K-LD50-ORL-RAT-4												71	
41	ETHYL DIETHANOLAMINE	L		200-B																	
42	ETHYLENE	G		-103-B																	
43	ETHYLENE CYANOHYDRIN	L	0.08-25	228-B				500-K-LDLO-IPR-HNN-4							U-460.00- 7					P-448064	
44	ETHYLENE DIAMINE	L	10.7-20	117-3		25	1	500 - TCLO-IHL-HNN-4	U-	8.40- 7											
45	ETHYLENE DIAMINETETRAACETIC ACID (ALSO EDTA)	S		240-D				2000-K-LD50-ORL-RAT-4												2000	
46	ETHYLENE DICHLORIDE	L	17.4-30	131.4-B	145	1		3050 - LCLO-IHL-GPG-4											I-	8615	
47	ETHYLENE DICHLORIDE (SEE 1,2-DICHLOROETHANE)	L	100-29.4	83.5-B	200	1		16500 - TCLO-IHL-HNN-4	U-	4.30-10											
48	ETHYLENE GLYCOL	L	0.05-20	197.5-B	250	1		1500-K-LDLO-ORL-HNN-4											U-	17210	
49	ETHYLENE GLYCOL DINITRATE				1.2	1		615-K-LD50-ORL-RAT-4												616	
50	ETHYLENE GLYCOL MONOBUTYL ETHER	L	0.6-20	171.2-B	245	4		950 - TCLO-IHL-HNN-4	U-	1.70- 7									U-	550	
51	ETHYLENE GLYCOL MONOETHYL ETHER	L	3.0-20	131.1-B	370	1		8780 - LCLO-IHL-HNN-4	U-	2.60- 7											
52	ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE	L	1.2-20	156.4-B	540	1		245 - LCLO-IHL-RAT-4	U-	0.75- 7											
53	ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE	L		143-B	25	1		2460-K-LD50-ORL-RAT-4	U-	3.10- 7										2460	

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	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							ODOUR-INFO PHY O-RAT QUANTITY						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	FORMAMIDE	L	29.7-129	210.7-P	30	1			2539-K-LD50-INS-GPG-4						0-300.00- 6						
2	FORMIC ACID	L	40-24	100.3-B	9	1			1100-K-LD50-ORL-MUS-4						0-450000- 6				I- 960		
3	FUMARIC ACID	S		287-M					200-K-LD50-IPR-MUS-4										I- 1040		
4	FURALTADONE																				
5	FURAZOLIDONE	S		255-M					11-K-TDLO-ORL-HMN-4												
6	FURFURAL	L		161.7-B	20	1			610-K-LCLC-IHL-PAT-4												
7	FURFURAL RESINS																				
8	FURFURAL																				
9	FURFURYL ALCOHOL	L		31.4-B																	
10	D-GALACTOSAMINE HYDROCHLORIDE				20	1			1020 - LCLC-IHL-RAT-4												
11	D-GALACTOSE PENTAACETATE																				
12	SASOLINE (UNLEADED)	L		257-I																	
13	GELATINE																				
14	GERMANIUM HYDRIDE	L		29-B	0.6	1															
15	D-GLUCAL																				
16	D-GLUCAL TRIACETATE																				
17	D-GLUCOSAMINE HCL																				
18	GLUCOSE	L																	U- 1610		
19	D-GLUCOSE PENTAACETATE																				
20	GLUTARIC ACID	S		97-M																	
21	GYCERINE	L	003-50	290-B					7750-K-LD50-ORL-GPG-4										U- 11090		
22	GLYCEROL																				
23	GLYCEROL MONOOLEATE	S		14-X																	
24	GLYCEROL MONOSTEARATE	S		58-M					200-K-LDLO-IPR-MUS-4												
25	GLYCEROL SORBITAN LAURATE																				
26	GLYCERYL TRIACETATE	L		258-B					150-K-LDLO-ORL-FRG-4												
27	GLYCERYL TRINITRATE	L	1-127	260-E	2	1			80-K-LDLO-ORL-RAT-4												
28	GLYCERYL TRISTEARATE	S		71.6-B					1320-K-TDLO-SCU-MUS-4												
29	GLYCIDOL	L		162-D	150	1			850-K-LD50-ORL-RAT-4										850		
30	GLYCINE	S		232-B																	
31	GOLD CYANIDE	S		-D																	
32	GOLD OXIDE	S		160-M																	
33	GOLD POTASSIUM BROMIDE	S																			
34	GOLD POTASSIUM CYANIDE	S																			
35	GOLD SODIUM CHLORIDE	S																			
36	GOLD SODIUM CYANIDE																				
37	GOLD TRICHLORIDE (SEE CHLORAUIC ACID)								1500-K-LDLO-SCU-MUS-4												
38	GONADOTROPIN																				
39	GRAPHITE	S			15	*	1														
40	GUANIDINE NITRATE	S		214-M																	
41	GUTHION	S		74-M	0.2	1			300-K-LD50-SKN-RAT-4												
42	HAFNIUM	S		2207-M	0.5	1															
43	HELIUM	G		-253-B																	
44	HEPARIN POTASSIUM	S																			
45	HEPARIN SODIUM	S																			
46	HEPTACHLOR (SEE INSECTICIDES)	S		95-M	0.5	1			420-K-LDLO-IPR-PAT-4												
47	HEPTANE	L	40-22.3	38-B	2000	1			40-K-LD50-ORL-RAT-4										40		
48	HEPTENE	L		36-B					4160 - TCLO-IHL-HMN-4						U-900.00- 6						
49	HEXACHLOROCYCLOPENTADIENE	L		239-B	0.01	1			505-K-LD50-ORL-RAT-4										505		
50	HEXACHLOROETHANE	S	1-32.7	186.6-S	9.7	1			325-K-LDLO-IVN-DUG-4												
51	HEXACHLOROAPHTHALENE	S																			
52	HEXACHLOROPHENE	S		151-M					0.043-K-TOLO-ORL-HMN-4												
53	HEXAETHYLTETRAPHOSPHATE	L		150-D					15-K-LDLO-SKN-RAT-4												
54	HEXAFLUOROACETONE	G			0.7	1			191-K-LD50-ORL-RAT-4										191		

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COMPOUND NAME

PHYSICAL-PROPERTIES

TLV-TWA-CAP

TOXIC-TEST-DATA

OCCUR-INFO PHY O-RAT QUANTITY

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

INVERTASE

IODINE

IODOACETIC ACID

4-ICDO-3,5-DINITROBENZANILIDE

3-ICDO-3-NITROSALICYLANILIDE

2-ICDO-3-NITROSALICYLANILIDE

4-ICDO-3-NITROSALICYLANILIDE

5-ICDO-5-NITROSALICYLANILIDE

1-ICDO-PHENOL

O-ICDO-PHENOL

P-ICDO-PHENOL

1-ICDO-SUCCINATE

ISIRIL

IRON BLUE

IRON 2-ETHYLHEXOATE

IRON DEXTRAN

IRON LAMPHERATE

IRON OXIDE (FUME)

IRON PENTACARBONYL

IRON SALTS (SOLUBLE)

IRON SELENIDE

IRON SORBITOL

IRON TALLATE

ISOBUTYL ACETATE

ISOBUTYL ALCOHOL

ISOBUTYL NITROSONITROGUANIDINE

ISOBUTYL THIOCYANOACETATE

ISOBUTANE

ISOBUTYL ACETATE

ISOBUTYL ALCOHOL

ISOBUTYLENE

ISOBUTYL NITROSONITROGUANIDINE

ISOBUTYL METHYLCYCLOHEXYL PHTHALATE

ISOOCTYLE

ISOOCTYL ALCOHOL

ISOOCTYL EPOXY TALLATE

ISOOCTYL STEARATE

ISOPHOSPHORIC

ISOPHTHALIC ACID

ISOPRENE

ISOPHENYL ALUMINUM

P-ISOPROPOXY DIPHENYL

P-ISOPROPOXY DIPHENYLAMINE

ISOPROPYL ACETATE

ISOPROPYL ALCOHOL

ISOPROPYL AMINE (SEE MONOISOPROPYLAMINE)

ISOPROPYL AMINE CODECYLBENZENE SULPHONATE

P-ISOPROPYLANILINE

ISOPROPYL ETHER

ISOPROPYL GLYCIDYL ETHER

1-ISOPROPYL-N-PHENYL-PARA-PHENYLENECAMINE

ISOTHIAZOLE

ISOTHIAZOLE 4-CARBOXYLIC ACID

ISOTHIAZOLE 5-CARBOXYLIC ACID

S

1-38.7

112.9-M

1

1

2000-K-LDLO-ORL-RAT-4

116-K-LD50-ORL-MUS-4

I- 200

15-K-LDLO-IPR-MUS-4

15-K-LDLO-IPR-MUS-4

4000-K-LDLO-SCU-RAT-4

S

2400-M

U- 55

2500-K-LDLO-IPR-RAT-4

S

40-30.3

1420-M

5

1

7 - LDLO-IHL-MUS-4

UE- 73460

L

105-B

0.08

1

S

1

1

L

142-B

525

1

1065 - TCLO-IHL-MUS-4

U- 0.018-10

L

142-B

360

1

3970-K-LD50-SKN-RAT-4

U- 0.001-10

L

10-12.8

116-B

700

1

38600 - LCLO-IHL-RAT-4

U- 2.38- 7

L

10-21.7

107.9-B

300

1

24500 - LCLO-IHL-RAT-4

U- 0.009-10

L

3290-40.5

-6.9-B

0.2-K-LD50-ORL-RAT-4

0.2

L

40.6-21

99.2-B

1480-K-LD50-ORL-RAT-4

1480

I- 2065

L

1-38

215.2-B

28

1

2330-K-LD50-ORL-RAT-4

U- 3.10- 7

2330

S

385-B

I- 890

L

34-B

180 - LC50-IHL-RAT-4

I- 1595

L

40-17

88.4-B

950

1

850 - TCLO-IHL-MUS-4

U- 3.76- 7

U- 760

L

33-20

82.3-B

980

1

192-K-LDLO-ORL-MUS-4

U- 18.4- 7

U- 2975

L

31.7-B

12

1

1960 - LDLO-IHL-RAT-4

U- 1.72- 7

L

150-25

68.5-B

1050

1

1180-K-LD50-ORL-RAT-4

U- 0.22- 7

1130

L

240

1

3400 - TCLO-IHL-MUS-4

U- 0.22- 7

4200-K-LD50-ORL-RAT-4

4200

555-K-LD50-ORL-RAT-4

555

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT QUANTITY								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ISOXAZOLE																				
JET FUEL	L																			
KEROSENE	L		175-B																	
KETENE	G		-56-B	0.9	1															
KORAX (SEE CHLORONITROPROPANE)	L		139.3-B																	
KRYPTON	G		-152-B																	
LACTIC ACID	L		122-B																	
LACTONITRILE	L		103-B																	
LANOLIN	S		37.1-M																	
LEAD OIL	L		-2-M																	
LATEX																				
LAURIC ACID	S	1-121	43-M																	
LAURIC DIETHANOLAMIDE																				
LAURIC ISOPROPANOLAMIDE																				
LAURIC MONOETHANOLAMIDE																				
LAURYL ALCOHOL	L		257-B																	
LAURYL ALCOHOL POLYETHYLENE GLYCOL																				
LAURYL DIMETHYLBENZYLAMMONIUM CHLORIDE																				
LAURYL ISOCQUINOLINIUM BROMIDE	L																			
LEAD (PURE DUST)	S	1-973	327-M	0.15	1															
LEAD ACETATE	S		75-M																	
LEAD ARSENATE (SEE INSECTICIDES)	S			0.15	1															
LEAD AZIDE	S																			
LEAD AZOTETRAZOLE																				
LEAD CARBONATE	S		311-D	.256	4															
LEAD CHLORIDE	S	1-547	50-B	.269	4															
LEAD CHLORITE	S		120-E																	
LEAD CHROMATE	S		84-M	0.10	4															
LEAD CYANIDE	S			0.25	4															
LEAD DINITRORESORCINATE																				
LEAD 2-ETHYLHEXOATE																				
LEAD FUMRATE																				
LEAD ISODECAOATE																				
LEAD MONOXIDE	S		88-M	.215	4															
LEAD NAPHTHENATES																				
LEAD NITRODECAOATE																				
LEAD NITRATE	S		470-D	0.32	4															
LEAD OXIDE BROWN	S	1-943	691-M	0.23	4															
LEAD PERCHLORATE	S		100-D	0.44	4															
LEAD PHOSPHITE	S		-D																	
LEAD PHTHALATE																				
LEAD SILICATE	S		761-M	.273	4															
LEAD STEARATE	S		111-M																	
LEAD STYPHATE	S		311-E																	
LEAD SULPHATE	S		1001-M	.293	4															
LEAD TALLATE																				
LEAD TETROXIDE				0.22	4															
LEAD TRI-ITROPHLOROGLUCINATE																				
LECITHINE																				
LIGANDSULPHONATES																				
LINOLEIC ACID	L		231-B																	
LINSEED OIL	L		20-M																	
LIQUIFIED PETROLEUM GAS				1600	1															
LITHIUM	S	1-723	17-M																	

I- 435

U- 95
P- 18644

I- 170

2730

230

PI-206749

130

U- 490

U- 10325

U- 280

U- 160

U- 280

AS- 2797

UE- 23291

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT QUANTITY								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
LITHIUM ALUMINUM HYDRIDE	S																			
LITHIUM CHLORIDE	S	1-547	612-M						757-K-LD50-ORL-RAT-4										757	
LITHIUM HYDROXIDE	S		680-M	0.03		1			22 - LCL0-IHL-RAT-4											
LITHIUM NAPHTHENE																				
LITHIUM NITRATE	S		250-M																	
LITHIUM STEARATE																				
LITHOCHOLIC ACID									3900-K-LD50-ORL-MUS-4											
LIT-HOL RED																				U- 0.2
LITHOPHOSPHATES, CADMIUM																				U- 140
2-LYSEERGIC ACID																				
MAGNESIUM	S	1-621	650-M						230-K-LCL0-ORL-DOG-4											PI- 11876
MAGNESIUM ACETATE									3730-K-LD50-IVN-MUS-4											
MAGNESIUM ARSENATE	S								280-K-LCL0-ORL-RAT-4											
MAGNESIUM CARBONATE	S		350-D																	
MAGNESIUM CHLORATE	S		30-M						1000-K-LDL0-ORL-MUS-4											
MAGNESIUM CHLORIDE	S		700-M																	
MAGNESIUM DESOXYCHOLATE																				
MAGNESIUM HYDROXIDE	S		350-D																	
MAGNESIUM LAURYL SULPHATE																				
MAGNESIUM LIGNOSULPHONATES																				
MAGNESIUM NAPHTHENE																				
MAGNESIUM NITRATE	S		120-M																	
MAGNESIUM OXIDE (FUME)	S		2500-M	10		1			400 - TCL0-IHL-HMN-4										U- 2635	
MAGNESIUM SALICYLATE																				
MAGNESIUM SILICATE	S																			
MAGNESIUM STEARATE	S		800-M																	
MAGNESIUM SULPHATE	S		200-M						1750-K-LDL0-SCU-RAT-4										U- 255	
MAGNESIUM XYLENE SULPHONATE																				
MALACHITE GREEN	S		-M						75-K-LDL0-ORL-RAT-4											
MALEIC ACID	S		1300-M						700-K-LD50-ORL-RAT-4										708	
MALEIC ANHYDRIDE	S	1-44	50-M		1	1			250-K-LDL0-ORL-RAT-4	U- 1.0	-13								U- 1665	
MALEIC HYDRAZIDE	S		300-M						3860-K-LD50-ORL-RAT-4										3800	
MALEIC ACID	S		130-M						1310-K-LD50-ORL-RAT-4										1310	
MANGANESE AND COMPOUNDS	S	1-1292	1260-M		5	1			11 - TCL0-IHL-HMN-4										I- 2545	
MANGANESE ARSENATE	S																			
MANGANESE CARBONATE	S																			
MANGANESE CHLORIDE	S		650-M						210-K-LDL0-SCU-MUS-4											
MANGANESE CYCLOPENTADIENYLTRICARBONYL				0.1		1														
MANGANESE DIOXIDE	S		530-M						45-K-LDL0-IVN-RBT-4										U- 4400	
MANGANESE DISODIUM VERSEANATE																				
MANGANESE 2-ETHYLHEXOATE																				
MANGANESE ISODECANOATE																				
MANGANESE LINOLEATE																				
MANGANESE NAPHTHENATES																				
MANGANESE NODODECANOATE																				
MANGANESE NITRATE	S		250-M																	
MANGANESE SULPHATE	S		700-M						120-K-LD50-IPR-MUS-4											
MANGANESE TALLATE																				
MELAMINE	S	50-315	250-M						1600-K-LDL0-ORL-MUS-4										U- 375	
MELAMINE FORMALDEHYDE RESINS																			I- 755	
MENTHOL	S	1-56	420-M						3180-K-LD50-ORL-RAT-4										3180	I- 45
NEPROBANATE																				
NEPRYLCAINE HYDROCHLORIDE																				
2-MERCAPTOBENZOTHAZOLE	S		170-M																	

[illegible]

[illegible]

[illegible]

COMPOUND NAME		PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							OCCUR-INFO PHY O-RAT QUANTITY						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	NITROGEN TRIFLUORIDE	G		-129-B	29																
2	NITROGLYCERIN	L	1-127	250-E	1.9	1			80-K-LDL0-ORL-RAT-4												
3	NITROGUANIDINE	S		246-B																	
4	NITROHYDROCHLORIC	L																			
5	NITROMETHANE	L	27.8-20	101-B	250	1			2446 - LCL0-IHL-MKY-4												
6	3-NITRO-4-METHOXYBENZOIC ACID																				
7	NITROPARAFFIN	L		103-F																	
8	O-NITROPHENOL	S	1-49.3	45-M					1297-K-LD50-ORL-RAT-4										1297		
9	P-NITROPHENOL	S		113-M					350-K-LD50-ORL-RAT-4										350		
10	P-NITROPHENYL-HYDRAZINE								250-K-LDL0-IPH-MUS-4												
11	P-NITROPHENYL-HYDRAZINE HYDROCHLORIDE																				
12	P-NITROPHENYL-A-D-MANNOPYRANOSIDE																				
13	NITROPHENYLPHOSPHORODICHLORIDATE																				
14	P-NITROPHENYLTHYMIDINE-3-PHOSPHATE																				
15	P-NITROPHENYLTHYMIDINE-5-PHOSPHATE																				
16	1-NITROPROPANE	L	7.5-20	152-B	90	1			250-K-LDL0-ORL-RBT-4												
17	2-NITROPROPANE	L	10-15.8	120-B	90	1			55 - TOL0-IHL-HMN-4												
18	2-NITRO-P-SALICYLANILIDE																				
19	4-NITRO-O-SALICYLANISIDINE																				
20	3-NITRO-2,3-SALICYLOXYLICIDE																				
21	3-NITRO-2,4-SALICYLOXYLICIDE																				
22	3-NITRO-2,5-SALICYLOXYLICIDE																				
23	3-NITRO-2,6-SALICYLOXYLICIDE																				
24	N-NITROSCIPHENYLAMINE	S		87.8-M	CAR	1	C														
25	N-NITROTOLUENE	L	1-50.2	232-B	30	1			330-K-LDL0-ORL-MUS-4												
26	O-NITROTOLUENE	L	1-50	220-B	30	1			891-K-LD50-ORL-RAT-4										391		
27	P-NITROTOLUENE	L	1-53.7	238-B	30	1			1231-K-LD50-ORL-MUS-4												
28	NITROTRICHLOROMETHANE (ALSO CHLOROPICRIN)	L	40-34	112-B	0.7	1			27 - TOL0-IHL-HMN-4												
29	NITROUS OXIDE	G		-88.5-B																	
30	NONELE	L		150-B																	
31	NONYL PHENOL	L		290-B					1620-K-LD50-ORL-RAT-4										1262		
32	NONYL PHENOL ETHOXYLATE																				
33	NONYL PHENOL POLYETHYLENE GLYCOL ETHER SULFATE																				
34	NUCLEIC ACID																				
35	NYLON 6	S																			
36	NYLON 66	S																			
37	OCTACHLORONAPHTHALENE				0.1	1															
38	OCTADECYLAMIDE																				
39	OCTALE	L	10-19.2	126-B	1900	1									U-	700-11					
40	N-OCTYL-N-DECYL ADIPATE	L		220-B																	
41	N-OCTYL-N-DECYL PHTHALATE	L		232-B																	
42	P-OCTYL DIPHENYLAMINE																				
43	OCTYLNITROSONITROGUANIDINE																				
44	OCTYL PHENOLS	S		280-B					25-K-LDL0-IPH-MUS-4												
45	OIL-CRUDE	L																			
46	OIL-CUTTING (MIST)	L			5	1															
47	OIL-FUEL-LIGHT	L																			
48	OLEIC ACID	L	1-176.5	286-B					50-K-LDL0-IVN-CAT-4												
49	OLEIC DIETANOLAMIDE																		U-	2045	
50	OLEIC MONOETHANOLAMIDE																				
51	OLEYL ALCOHOL	L		333-B																	
52	OLEYL AMIDE																				
53	OLEYL HYDROXYMETHYL IMIDAZOLINE																				
54	OLIVE OIL	L		225-F																	

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO					PHY O-RAT QUANTITY				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
OSMIUM TETROXIDE	S		2700-M	.002	1			0.1	-	TCL0-IHL-HMN-4											
OXALIC ACID	S		101-M	1	1			700-K	-	LCL0-ORL-HMN-4								2830	I-	435	
OXYDIPIRONITRILE	L		153-B					2830-K	-	LD50-ORL-RAT-4											
OXYGEN	G		-183-B																	AS-432589	
OXYGEN DIFLUORIDE	G		-145-B	0.1	1			6.6	-	LC50-IHL-RAT-4											
OZONE	G		-112-B	0.2	1			2	-	TCL0-IHL-HMN-4	U-	0.01-	8	P							
PALLADIUM AMINE NITRATE																					
PALLADIUM BLACK																					
PALLADIUM CHLORIDE	S		501-M					19-K	-	LCL0-IVN-RBT-4											
PALMITIC ACID	S		352-B					57-K	-	LD50-IVN-MUS-4											
PALMITIC DIETHANOLAMIDE																					
PALMITIC MONOETHANOLAMIDE																					
PALMITYL BENZYL AMMONIUM CHLORIDE																					
PALM OILS	S		27-M																PI-	26764	
PAN								525	-	LC50-IHL-MUS-5						P					
PARAFFIN WAX (FUMES)	S		50-M	2	1			600-K	-	TCL0-IMP-MUS-4											
PARAFORMALDEHYDE	S	1.45-25	120-M																U-	125	
PARATHION (SEE INSECTICIDES)	L		375-M	0.1	1			2-K	-	LD50-ORL-RAT-4								2			
PEANUT OIL	L		282-F																PI-	17086	
PELODIETRAZINE BITARTRATE																					
PENTAMETRAZINE HYDROCHLORIDE																					
PENTABORANE (STABLE)	G	66-0	0.0-B	0.01	1			9	-	LC50-IHL-MUS-4											
PENTACHLOROETHANE	L		159-B					35600	-	LCL0-IHL-RAT-4											
PERCHLOROMETHYL MERCAPTAN	L		145-B	0.8	1			83-K	-	LD50-ORL-RAT-4								83			
PENTACHLORONAPHTHALENE	S			0.5	1																
PENTACHLOROPHENOL	S	40-211	191-M	0.5	1			29-K	-	LDL0-ORL-HMN-4											
PENTAERYTHRITOL	S		276-B	10	1														U-	3800	
PENTAERYTHRITOL TETRANITRATE	L		135-M																		
n-PENTANE	S	400-19.5	36-B	1475	1			390000	-	TCL0-IHL-HMN-4											
PENTASODIUM DIETHYLENETRIAMINEPENTAACETATE	S																				
PENTASODIUM TRIPHOSPHATE	S							525-K	-	LD50-IPR-RAT-4											
PEPTONE OF CASEIN	S																				
PERCHLORIC ACID	L		19-B																		
PERCHLOROETHYLENE	L	15.8-22	121-B	670	1			1585	-	TCL0-IHL-HMN-4	U-	31.90-11									
PERCHLORYL FLUORIDE	G		-47-B	14	1			1640	-	LC50-IHL-RAT-4											
PERLITE	S			30	#	1															
PEROXYACETYL NITRATE (SEE PAN)																					
PHENANTHRAQUINONE	S							20-K	-	LCL0-SKN-MUS-4						P					
P-PHENANTHROLINE	S																				
PHENAZINE-1-CARBOXYLIC ACID																					
o-PHENETIDINE	L	1-67	230-B																I-	130	
p-PHENETIDINE	L		253-B																		
PHENOL	S	1-40	40.5-M	19	1			14-K	-	LDL0-ORL-HMN-4	U-	0.18-14							U-	29595	
PHENOL FORMALDEHYDE RESINS	S																		AS-	44260	
PHENOTHAZINE (ALSO THIODIPHENYLAMINE)	S		177-M	5	1			5000-K	-	LD50-ORL-RAT-4								500			
4-PHENYLazo-3-NITROSALICYLANILIDE																					
PHENYLazOPYRIDINE HYDROCHLORIDE																					
p-PHENYLENE DIAMINE	S		140-M	0.1	1			100-K	-	LCL0-ORL-PAT-4											
o-PHENYLENEPHOSPHOROCHLORIDATE																					
o-PHENYLENEPHOSPHOROCHLORIDITE																					
PHENYL ETHER				7	1			4000-K	-	LDL0-ORL-RAT-4											
PHENYL GLYCIDYL ETHER	L		245-B	62	1			3650-K	-	LD50-ORL-PAT-4								3650			
PHENYLHYDRAZINE	S	1-71.9	19.6-M	22	1			165-K	-	LD50-ORL-RAT-4									196		
PHENYLMAGNESIUM CHLORIDE	S																				

	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						ODOUR-INFO PHY Q-RAT QUANTITY						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	POTASSIUM BIPHTHALATE																			
2	POTASSIUM BITARTRATE	S																		
3	POTASSIUM BROMATE	S		434-M															U-	180
4	POTASSIUM T-BUTOXIDE																			
5	POTASSIUM N-BUTYL XANTHATE																			
6	POTASSIUM CASEINATE																			
7	POTASSIUM CHLORATE	S		366-M					1500-K-LDLO-ORL-RAT-4									U-	515	
8	POTASSIUM CHLORIDE	S		790-M					2430-K-LDLO-ORL-RAT-4									UE5717205		
9	POTASSIUM CHLOROPLATINATE	S		250-D																
10	POTASSIUM CHROMATE	S		971-M	0.1	4		430-K-LDLO-ORL-HMN-4												
11	POTASSIUM CITRATE	S		-D																
12	POTASSIUM CLUPROCYANIDE	S																		
13	POTASSIUM CYANIDE	S		635-M	5	4		10-K-LD50-ORL-RAT-4									10			
14	POTASSIUM DICHROMATE	S		395-M																
15	POTASSIUM DINITROCRESORCINATE																			
16	POTASSIUM DODECYL BENZENE SULPHONATE																			
17	POTASSIUM ETHYL XANTHATE	S		200-M					400-K-LDLO-SCU-MUS-4											
18	POTASSIUM FERRICYANIDE	S		-D					1600-K-LDLO-ORL-RAT-4											
19	POTASSIUM FLUORIDE (ANHYDROUS)	S	1-885	880-M	7.6	4			245-K-LD50-ORL-RAT-4								245			
20	POTASSIUM HYDROXIDE	S	1-719	360-M	2	1			365-K-LDKO-ORL-RAT-4								365	U-	4720	
21	POTASSIUM IODATE	S		560-M																
22	POTASSIUM IODIDE	S	1-745	722-B					120-K-LDLO-IVN-RAT-4									U-	10	
23	POTASSIUM ISOPROPYL XANTHATE																			
24	POTASSIUM LAURYL ETHER SULPHATE																			
25	POTASSIUM LAURYL SULPHATE																			
26	POTASSIUM LIGNOSULPHONATES																			
27	POTASSIUM LINOLEATE	S																		
28	POTASSIUM NAPHTHENATE	S																		
29	POTASSIUM NITRATE	S		334-M																
30	POTASSIUM OLEATE	S																		
31	POTASSIUM OSIMATE	S		100-M																
32	POTASSIUM OXYALATE	S		-D																
33	POTASSIUM PALLADIUM CHLORIDE	S																		
34	POTASSIUM PERMANGANATE	S		240-D				1090-K-LD50-ORL-RAT-4									1090			
35	POTASSIUM PEROXIDE	S		490-M																
36	POTASSIUM PHOSPHATES	S																I-	1900	
37	POTASSIUM N-PROPYL XANTHATE																			
38	POTASSIUM SILICATE (TETRA)	S																I-	1030	
39	POTASSIUM SILVER CYANIDE								21-K-LD50-ORL-RAT-4								21			
40	POTASSIUM STANNATE	S																		
41	POTASSIUM SULPHATE	S		1072-M				3000-K-LDLO-SCU-GPG-4										I-	20450	
42	POTASSIUM SULPHIDE	S																		
43	POTASSIUM TARTRATE	S																		
44	POTASSIUM TELLURITE	S		460-M					35-K-LDLO-IVN-DOG-4											
45	POTASSIUM TETRACRATE	S		-D																
46	POTASSIUM THIOCYANATE	S		170-M					80-K-LDLO-ORL-HMN-4											
47	POTASSIUM TITANIUM FLUORIDE	S																		
48	POTASSIUM TOLUENE SULPHONATE																			
49	POTASSIUM XYLENE SULPHONATE																			
50	PROCCOPPERAZINE DIMALEATE								400-K-LD50-ORL-MUS-4											
51	PROLACTIN	S																		
52	PROPAMINE HYDROCHLORIDE	S																		
53	1-PROPYLE	G		-42.5-B	1800	1											U- 36080-10		P-452700	
54	PROPARGYL ALCOHOL	L	11.6-20	11.3	2	1		0.07-K-LDLO-ORL-RAT-4										0.07		

	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							OCCUR-INFO PHY O-RAT QUANTITY					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	B-PROPIOLACTONE	L		150-D	CAR	1	C		50-K-LDLO-ORL-RAT-4											
2	PROPIONALDEHYDE	L		48.0-B					19300 - LCLO-IHL-RAT-4 U-	0.09-	7									
3	PROPIONHYDROXYMIC ACID																			
4	PROPIONIC ACID	L	10-40	140-B					500-K-LD50-SKN-RBT-4 U-	0.05-	10									
5	N-PROPYL ACETATE	L	40-29	101.0-B	840	1			34000 - LCLO-IHL-RAT-4 U-	0.63-	7								U-	330
6	N-PROPYL ALCOHOL	L	10-14.7	97.0-B	490	1			10000 - LCLO-IHL-RAT-4 U-	0.20-	7								U-	1440
7	N-PROPYL AMINE (SEE MONO-N-PROPYLAMINE)	L	242-20	40-B					5680 - LC50-IHL-RAT-4											
8	N-PROPYL-N,N-DI-N-PROPYL THIOCARBAMATE								1630-K-LD50-ORL-RAT-4									1630		
9	PROPYLENE	G	104-20	-47.0-B																
10	PROPYLENE DICHLORIDE	L	40-19.4	96.0-B	350	1			9400 - LCLO-IHL-RAT-4 U-	2.31-	7									
11	PROPYLENE GLYCOL	L	0.08-20	160-B															U-	7350
12	PROPYLENE GLYCOL ALGINATE	S		150-B																
13	PROPYLENE GLYCOL MONOBUTYL ETHER																			
14	PROPYLENE GLYCOL MONOMETHYL ETHER	L		120-B	360	1			26240 - LCLO-IHL-RAT-4											
15	PROPYLENE GLYCOL MONOSTEARATE								200-K-LDLO-IPR-MUS-4											
16	PROPYLENE IMINE	L		60-B	5	1			19-K-LD50-ORL-RAT-4									19		
17	PROPYLENE CYCIDE	L	400-17.8	30-B	240	1			4200 - LC50-IHL-MUS-4 U-	83.20-	7									
18	PROPYLENE PICOXYTOL																			
19	n-PROPYL TITRATE	L		110-B	110	1			100-K-LCLO-IVP-DOG-4											
20	PROPYLNITROSODITHIOGUANIDINE																			
21	PROVIDONE-IONINE																			
22	PYRETHRU (EXTRACT)																			
23	PYRIDINE	L	10-13.2	115.0-B	5	1			1500-K-LDLO-ORL-RAT-4											
24	PYRIDOXINE HYDROCHLORIDE	S		200-M					1315 - LC50-IPL-RAT-4 U-	0.04-	10									
25	PYRIDYL MERCURIC ACETATE																			
26	PYROCATETROL	S	10-118	100-M					3090-K-LD50-ORL-RAT-4									3890		
27	PYROGALLOL	S	10-167	130-M					789-K-LDLO-ORL-RAT-4									789		
28	RYBINIUM PAMPATE																			
29	QUASSIN	S																		
30	QUATERNARY AMMONIUM NAPHTHENATE																			
31	QUINACRINE HYDROCHLORIDE	S		240-D					714-K-LDLO-ORL-CKN-4											
32	QUINHYDRONE	S		170-M					225-K-LDLO-ORL-RAT-4											
33	QUININE	S																		
34	QUINONE	S		110-M	0.4	1			320 - LCLO-IHL-MUS-4											
35	RAPESEED OIL	L		160-F																
36	RDX (CYCLOTRIMETHYLENE TRINITRAMINE)	S		200-M	1.5	1			200-K-LD50-ORL-RAT-4									200		P- 80238
37	RESORCINOL (SEE 2-DIHYDROXY BENZENE)	S	1-108	110-M	2	1			301-K-LD50-ORL-RAT-4									301	I-	735
38	RHODAMINE TONER								2-K-LDLO-IPR-MUS-4											
39	RHODIUM (METAL FUME AND DUSTS)	S		1980-M	0.1	1														
40	RHODIUM (SOLUBLE SALTS)	S		1980-M	0.01	1														
41	D-PIPOSE-5-PHOSPHORIC ACID																			
42	RICE BRAN OIL	L																		
43	RICINOLEIC ACID	L		220-B					60-K-LDLO-SCU-RAT-4											
44	ROCK WOOL (ALSO MINERAL WOOL,SLAG WOOL)	S				10	1													
45	ROBIN	S		100-M																
46	SAFFLOWER OIL	L																	U-	320
47	SALICYLALDEHYDE	L	1-33	190-B					1000-K-LDLO-SCU-RAT-4											
48	SALICYLHYDRAZINE																			
49	SALICYLIC ACID (SEE O-HYDROXYBENZOIC ACID)	S	1-114	150-M					891-K-LD50-ORL-RAT-4									891		
50	SELENIUM (COMPOUNDS)	S	1-356	170-M	0.2	1			7-K-LD50-ORL-RAT-4									7	P-	426
51	SELENIUM DIETHYLDITHIOCARBAMATE	S						4 C	1700-K-TOLO-ORL-MUS-4											
52	SELENIUM DIOXIDE	S	1-157	340-M	0.2	4			4-K-LD50-SCU-RAT-4											
53	SELENIUM HEXAFLUORIDE	G		-34.0-B	0.4	1			79-K-LCLO-IHL-RAT-4											
54	SELFIOUS ACID	S		-0																

	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							ODOUR-INFO PHY O-RAT QUANTITY					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	SHELLAC	L		15-F																
2	SILICA (AMORPHOUS)	S	10-1732	1700-M	20	*	1		3160-K-LD50-ORL-RAT-4										3160	
3	SILICON	S	1-1724	1420-M	10		1													
4	SILICON CARBIDE	S		2600-M	30	*	1													E-105996
5	SILICON MONOXIDE	S		1700-M																
6	SILICON TETRACHLORIDE	L		15-E					56500 - LC50-IHL-RAT-4											
7	SILICON TETRAHYDRIDE				0.7		1		12500 - LCL0-IHL-MUS-4											
8	SILVER																			
9	SILVER ACETATE	S		-D																
10	SILVER AMINE NITRATE	S																		
11	SILVER AZIDE	S		250-M																
12	SILVER BORATE (TETRA)	S																		
13	SILVER BROMATE	S		-D																
14	SILVER BROMIDE	S																		
15	SILVER CAPRYLATE	S		218-M																
16	SILVER CHLORATE	S		210-M																
17	SILVER CHLORIDE	S	1-912	405-M																
18	SILVER CHRONATE	S																		
19	SILVER CITRATE	S																		
20	SILVER CRYSTAL CATALYST																			
21	SILVER CYANIDE	S		320-M					123-K-LD50-ORL-RAT-4										123	
22	SILVER DICHROMATE	S		-D																
23	SILVER IODATE	S		200-M																
24	SILVER IODIDE	S	1-820	508-M																
25	SILVER LACTATE	S																		
26	SILVER NITRATE	S		212-M	.015		4		50-K-LD50-ORL-MUS-4											
27	SILVER OXIDE	S		-D					2820-K-LDL0-ORL-RAT-4											
28	SILVER PHOSPHATE	S		509-B																
29	SILVER SULFATE	S		602-M																
30	SILVER SULPHITE	S		100-M																
31	SILVER SULPHITE	S		-D																
32	SOAPSTONE (ALSO TALC)	S			20	*	1													
33	SOSA CELLULOSE																			
34	SODIUM	S	1.2-400	92-M																U= 9775
35	SODIUM ACETATE (ANHYDROUS)	S		324-M					335-K-LD50-IVN-MUS-4											
36	SODIUM ACID PYROPHOSPHATE	S		220-M					480-K-LD50-SCU-MUS-4											
37	SODIUM ALGinate	S																		
38	SODIUM ALUMINATE	S		160-M																U= 1345
39	SODIUM AMYL XANTHATE																			
40	SODIUM ANTHRACENONE ALPHA-SULPHONATE																			
41	SODIUM ASCORBATE	S		218-M																
42	SODIUM ARSENATE	S		86.3-M			C		4 - TCL0-IHL-HMN-4											
43	SODIUM ARSENITE	S							41-K-LD50-ORL-RAT-4										41	
44	SODIUM AZIDE	S		-D					46-K-LDL0-ORL-RAT-4											
45	SODIUM BENZENESULPHONATE								3200-K-LD50-ORL-MUS-4											
46	SODIUM BENZOATE	S							4100-K-LD50-ORL-RAT-4										4100	
47	SODIUM O-BENZOYL SUPPHIMIDE																			
48	SODIUM BICARBONATE	S		270-D																
49	SODIUM BICHRONATE	S		100-M																I= 9645
50	SODIUM BISULPHATE	S		315-M																
51	SODIUM BISULPHITE	S							650-K-LD50-IPR-RAT-4											
52	SODIUM BORATE	S		711-M					210-K-TCL0-ORL-HMN-4											I= 11775
53	SODIUM BROMIDE	S	1-806	715-M					5000-K-LD50-IPR-MUS-4											U= 32
54	SODIUM P-BENZO-BENZENESULPHONATE																			

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							OCCUR-INFO PHY O-RAT QUANTITY						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
SODIUM N-BUTYL SULPHONATE																				
SODIUM N-BUTYL XANTHATE																				
SODIUM S-BUTYL XANTHATE																				
SODIUM BUTYRATE																				
SODIUM CACODYLATE	S		67-M																	
SODIUM CARBOXYLATE	S		851-M																	
SODIUM CARBOXYLATE	S		103-D																	
SODIUM CARBOXYLATE PEROXIDE																				
SODIUM CARBOXYLETHYL ROSIN AMINE																				
SODIUM CARBOXYLMETHYL CELLULOSE	S																			
SODIUM CASEINATE	S																			
SODIUM CELLULOSE XANTHATE																				
SODIUM CETYL SULPHATE																				
SODIUM CHLORITE	S		173-D																	
SODIUM CHLORIDE	S	1-865	801-M																	
SODIUM P-CHLOROBENZENE SULPHONATE																				
SODIUM CHLOROPLATINATE	S		153-M	.005	4			.0009	-	TCLD-IHL-HMN-4										
SODIUM 2-CHLOROTOLUENE-4-SULPHONATE																				
SODIUM 2-CHLOROTOLUENE-5-SULPHONATE																				
SODIUM CHOLATE																				
SODIUM CHROMATE	S		791-M																	
SODIUM CITRATE	S		157-D																	
SODIUM COPPER CYANIDE																				
SODIUM CYANIDE	S	1-817	561-M	5	4			6.44	-K-LD50-ORL-RAT-4											
SODIUM DECYL SULPHATE																				
SODIUM DEHYDROCHOLATE																				
SODIUM 2,5-DICHLOROBENZENE SULPHONATE																				
SODIUM DICHROMATE	S		109-M	0.1	4			140	-K-TCLD-TMS-RAT-4											
SODIUM DIETHYLENEDIAMINE CARBAMATE	L		16-M																	
SODIUM DIMETHYLDITHIOCARBAMATE	S																			
SODIUM 2,2-DIMETHYL-2-SILAPENTANE-5-SULPHONATE																				
SODIUM DODECYLBENZESULPHONATE	S																			
SODIUM DINITROPHENATE																				
SODIUM 2-ETHYLHEXYL SULPHATE																				
SODIUM ETHYL XANTHATE	S																			
SODIUM FERROCYANIDE	S																			
SODIUM FLUORIDE	S	1-1077	981-M	5.5	4			4	-K-LDLO-ORL-HMN-4											
SODIUM FLUOROACETATE	S		201-D	0.05	1			220	-K-LD50-ORL-RAT-4											
SODIUM FLUOROBORATE																				
SODIUM FORMYLDEHYDE BISULPHITE	S																			
SODIUM FORMATE	S		251-M																	
SODIUM GLUCONATE	S																			
SODIUM GLUTAMATE	S																			
SODIUM HEXAHYDROXYPLATINATE																				
SODIUM HEXAETHAPHOSPHATE	S																			
SODIUM HYDRIDE	S		801-M																	
SODIUM HYDROSULPHIDE	S		351-M																	
SODIUM HYDROSULPHITE	S		551-M																	
SODIUM HYDROXYLIDE	S	1-739	311-M	2	1			500	-K-LDLO-ORL-RBT-4											
SODIUM HYPOCHLORITE	S		-D																	
SODIUM IODATE	S		-D																	
SODIUM IODIDE	S		651-M																	
SODIUM ISOPROPYL XANTHATE	S		151-D																	
SODIUM ISOTHIONATE																				
SODIUM LAURYL-N-METHYL TAURIDE																				

PI1114519
U- 140

3200
AS-344592

U- 775

P-120227
PI3670021

U- 115

6.44 I- 4760

U- 152
220

1660 I- 1955

4340

COMPOUND NAME		PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA						OCCUR-INFO PHY O-RAT QUANTITY					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	SODIUM LAURYL ETHER SULPHATE																		
2	SODIUM LAURYL ETHER SULPHOSUCCINATE																		
3	SODIUM LAURYL N-ETHANOLANIDE SULPHOSUCCINATE																		
4	SODIUM LAURYL SULPHATES	S						1288-K-LD50-ORL-RAT-4									1298		
5	SODIUM LIGNOSULPHONATES																		
6	SODIUM LITHOCHOLATE																		
7	SODIUM METASILICATE, ANHYDROUS	S		1089-M															
8	SODIUM METASILICATE, PENTAHYDRATE			100-D															
9	SODIUM N-ETHYL-N-OLEYLTAURATE	S																	
10	SODIUM N-ETHYL-N-OLEYLTAURATE							250-K-LD50-IMS-RAT-4											
11	SODIUM N-ETHYL-N-OLEYLTAURATE	S																	
12	SODIUM N-ETHYL-N-OLEYLTAURATE	S																	
13	SODIUM N-1-NAPHTHYL-PHTHALAMATE																		
14	SODIUM NITRATE	S		306-M				200-K-LDLO-ORL-RAT-4										UE- 40625	
15	SODIUM NITRATE	S		271-M				3-K-LDLO-ORL-RAT-4											
16	SODIUM N-NITROBENZENE SULPHONATE	S																	
17	SODIUM 4-NITROCHLOROBENZENE SULPHONATE																		
18	SODIUM NITROPRUSSIDE	S						20-K-LDLO-ORL-RAT-4											
19	SODIUM 4-NITROTOLUENE-2-SULPHONATE																		
20	SODIUM OLEATE	S		232-M															
21	SODIUM OLEYL SULPHATE																		
22	SODIUM ORTHOSILICATE	S		1018-M															
23	SODIUM OXALATE	S		250-D				100-K-LDLO-SCU-MUS-4											
24	SODIUM OXIDE	S		1275-B															
25	SODIUM PENTACHLOROPHENATE (SEE BIOCIDES)	S						164-K-LDLO-SKN-MUS-4											
26	SODIUM PERBORATE	S		62-M				539-K-LD50-IPR-MUS-4											
27	SODIUM PERCHLORATE	S		482-M				595-K-LD50-IPR-MUS-4											
28	SODIUM PEROXIDE	S		460-M															
29	SODIUM PERMANGANATE	S																	
30	SODIUM P-PHENOL SULPHONATE	S		-D															
31	SODIUM PHOSPHATE, DIBASIC							2000-K-LDLO-IPR-MUS-4										U- 75310	
32	SODIUM PHOSPHATE, MONOBASIC							250-K-LD50-IMS-RAT-4										U- 75310	
33	SODIUM PICRATE	S																	
34	SODIUM POTASSIUM ALLOY	S																	
35	SODIUM PROPIONATE	S						1640-K-LD50-SKN-RBT-4											
36	SODIUM PRUSSIAN, RED	S																U- 122	
37	SODIUM PRUSSIAN, YELLOW	S																U- 122	
38	SODIUM PYROPHOSPHATE	S		880-M				40-K-LDLO-ORL-MUS-4											
39	SODIUM SALICYLATE	S						700-K-LDLO-ORL-MUS-4											
40	SODIUM SELENATE	S		0.2	4			9-K-LDLO-ORL-MUS-4											
41	SODIUM SELENITE	S		0.2	4			7-K-LDLO-ORL-RAT-4											
42	SODIUM SESQUICARBONATE	S		-D														I- 4570	
43	SODIUM SESQUISILICATE	S																	
44	SODIUM SILICATE	S																U- 30015	
45	SODIUM STANNATE	S		140-D														U- 41605	
46	SODIUM STEARATE	S						400-K-LDLO-UNK-MUS-4											
47	SODIUM SULPHANETHAZINE																		
48	SODIUM SULPHATE	S		888-M				4470-K-LDLO-IVN-RBT-4										PI-542888	
49	SODIUM SULPHYRATE	S		350-M															
50	SODIUM SULPHIDE	S		1180-M				53-K-LD50-IPR-MUS-4										I- 1215	
51	SODIUM SULPHITE	S		-D				115-K-LD50-IVN-RAT-4										I- 5570	
52	SODIUM TARTRATE	S		150-D				1290-K-LD50-ORL-RAT-4										1290	
53	SODIUM TETRAPHENYLBORON																		
54	SODIUM THIOCYANATE	S		287-M				764-K-LD50-ORL-RAT-4										764	

	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA							ODOUR-INFO PHY O-RAT QUANTITY						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	SODIUM THIOSULPHATE	S																			
2	SODIUM TOLUENE SULFONATE	S																			
3	SODIUM TRIBASIC PHOSPHATE	S																			
4	SODIUM TRIDECYL ETHER SULPHATE																				
5	SODIUM TRIDECYL SULPHATE																				
6	SODIUM TRIPHOSPHATE	S																			
7	SODIUM TRIPLYPHOSPHATE	S																			
8	SODIUM VALERATE																				
9	SODIUM XYLENE SULFONATE																				
10	SORBITIC ACID	S	0.01-20																		
11	SORBITOL MONOSTEARATE	S																			
12	SORBITOL FATTY ESTERS	L																			
13	SORBITAN MONOLAUREATE	S																			
14	SORBITAN MONOPALMITATE	S																			
15	SORBITAN MONOSTEARATE	S																			
16	SORBITAN SESQUILAUROATE	S																			
17	SORBITAN TRISTEARATE	S																			
18	SORBITOL	S																			
19	SORBITOL HEXAOLEATE, ETHOXYLATED																				
20	SORBITOL MONOLOLEATE	S																			
21	SORBITOL SEPTAOLEATE, ETHOXYLATED																				
22	SOYBEAN OIL	L																			
23	SPEARMINT OIL	L																			
24	STANNIC CHLORIDE	L	10-10																		
25	STANNOUS CHLORIDE	S																			
26	STANNUS 2-ETHYLHEXANOATE	L																			
27	STARCH	S																			
28	STEARIC ACID	S	1-174																		
29	STEARYLAMINE																				
30	STEARYLAMINE, ETHOXYLATED																				
31	STEARYL BENZYL AMMONIUM CHLORIDE																				
32	STEARYL CETYL ALCOHOL, ETHOXYLATED																				
33	STEARYL CETYL SULPHATE																				
34	STEARYL DIMETHYL BENZYL AMMONIUM CHLORIDE																				
35	STEARYL SULPHATE																				
36	STIBINE (ALSO ANTIMONY HYDRIDE)	G																			
37	STRONTIUM	S	10-698																		
38	STRONTIUM ACETATE	S																			
39	STRONTIUM CHLORIDE	S																			
40	STRONTIUM CHROMATE	S																			
41	STRONTIUM FERRITE																				
42	STRONTIUM LACTATE																				
43	STRONTIUM NITRATE	S																			
44	STYROL	S																			
45	STYRENE MONOMER	L																			
46	4-STYRYL PYRIDINE																				
47	SUCCINIC ACID	S																			
48	SUCCINIC ACID 2,2-DIMETHYL HYDRAZIDE	S																			
49	SUCCINYL CHLORIDE																				
50	SUCROSE	S																			
51	SULPHADIAZINE																				
52	SULPHOXINE	L																			
53	SULPHUR (SEE FUNGICIDES)	S	1-184																		
54	SULPHUR DIOXIDE	G	2538-21.1																		

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT QUANTITY									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
SULPHUR HEXAFLUORIDE	G		63.8-B	6000	1																
SULPHURIC ACID		1-146	330-B	1	1			5	-	TCL0-IHL-HMN-4	U-	0.60-	3							PI2739263	
SULPHUR MONOCHLORIDE	L	10-27.5	138-B	6	1			830	-	LCL0-IHL-MUS-4	U-	0.0055-	14								
SULPHUR DIOXIDE	L																				
SULPHUR TRIOXIDE	L	100-10.5	44.8-B				0.4	1													
SULPHURYL FLUORIDE	G		-52 B																		
SUMIFLOWER OIL	L																				
SUPERPHOSPHATES																				PI- 16506	
TALC (NOV ASBESTIFORM)	S			20	*	1														U-224485	
TALL OILS	L		162-B																	U- 15175	
TALLOW	S		86-M																		
TANNIC ACID	S		200-M																		
TANTALUM (METAL AND OXIDE DUSTS)	S		3027-M	5	1			5000	-	K-L050-CRL-RBT-4											
TANTALUM CARBIDE	S		5550-B																		
TANTALUM-NIOBIUM CARBIDE																					
TAR (LIQID)	L																				
TARTARIC ACID	S		166-M					5000	-	K-L0L0-ORL-DOG-4										U- 315	
TEC (SEE DICHLORO-DIPHENYLDICHLOROETHANE INSECTICIDES)	S		110-M					400	-	K-L050-ORL-RAT-4										400	
TEAR GAS																					
TEOP (TETRAETHYL DITHIONOPYROPHOSPHATE)				0.2	1			5	-	K-L050-ORL-RAT-4										5	
TELLURIUM	S	1-520	452-M	0.1	1															P- 33	
TELLURIUM DIOXIDE	S		1245-B																		
TELLURIUM HEXAFLUORIDE	G		-35.5-B	0.2	1			49	-	L050-IHL-RAT-4											
TERPENE ALCOHOL																					
TERPHENYLS				9.4	1			500	-	K-L0L0-ORL-RAT-4											
TESTOSTERONE	S		155-M																		
TETRABROMOETHANE	L		151-D	14	1			400	-	K-L050-ORL-RBT-4											
1,2,4,5-TETRACHLORO BENZENE	S		47.5-M																		
1,1,1,2-TETRACHLORO 1,2-DIFLUOROETHANE				4170	1																
1,1,1,2-TETRACHLORO 2,2-DIFLUOROETHANE				4170	1			30	-	TCL0-ORL-HMN-4											
1,1,1,2-TETRACHLOROETHANE	L		146.3-B	35	1			6980	-	LCL0-IHL-RAT-4											
TETRACHLOROHYDROQUINONE																					
TETRACHLOROPHTHALENE	S		187-M	2	1			3	-	K-TCL0-IPL-HMN-4											
TETRACHLOROPHENOL	S		164-B					140	-	K-L050-ORL-RAT-4										140	
TETRAETHYL LEAD	L	1-38.4	194-M	0.12	1			50	-	LCL0-IHL-RAT-4											
TETRAETHYL THIURAM SULPHIDE	S		224-B					1000	-	K-L050-IPR-MUS-4											
TETRAHYDROFURAN	L	114-15	65.4-B	590	1			3000	-	K-L0L0-ORL-RAT-4										U- 88.00- 8	
TETRAETHYL LEAD	L		-22-B	0.15	1			109	-	K-L050-ORL-RAT-4										109	
TETRAETHYL-P-PHENYLENE DIAMINE	S		51-M																		
TETRAETHYL SUCCINONITRILE (TSN)	S		169-S	2.8	1			335	-	LCL0-IHL-RAT-4											
TETRAETHYL THIURAM DISULPHIDE	S		70-B	5	4			250	-	K-TCL0-ORL-MUS-4											
TETRAETHYL THIURAM MONOSULPHIDE	S							300	-	K-L0L0-IPR-MUS-4											
2,3,4,5-TETRAINITROBENZANILIDE																					
TETRAINITROETHANE	S	10-22.7	125.7-B					270	-	LCL0-IHL-RAT-4											
TETRAETHYLETHANE																					
TETRAETHYLETHANE																					
TETRAETHYLENE																					
TETRASODIUM ETHYLENEDIAMINETETRAACETATE																					
TETRASODIUM PYROPHOSPHATE	S		680-M					330	-	K-L050-IPR-MUS-4											
TETRAZENE	S							40	-	K-L0L0-ORL-MUS-4										U- 1235	
TETRAZOLE																					
TETRAZOLE																					
TFTRYL	S		130-M	1.5	1			5000	-	K-L0L0-SCU-DOG-4											
THALLIUM	S	1-825	302-M	0.1	1			0.00	-	K-TCL0-ORL-RAT-4										0.8	

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	COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR			TOXIC-TEST-DATE								ODOUR-INFO PHY O-RAT QUANTITY					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	THALLIUM SULPHATE	S		632-M																16	
2	THIOCARBAMIDE	L		180-M																	
3	THIOPHENE	S	40-12.5	64.1-B																	
4	THIOUREA	S		180-M																	
5	THORIUM	S		1845-M																	
6	THORIUM DIOXIDE	S		4400-B																	
7	THYROTROPIC HORMONE																				
8	TIN (INORGANIC COMPOUNDS)																				
9	TIN (ORGANIC COMPOUNDS)																				
10	TITANIUM	S		1800-M															I-	290	
11	TITANIUM CARBIDE	S		4300-B																	
12	TITANIUM DIOXIDE	S		1640-M															P1-	853659	
13	TITANIUM SULPHATE	S																			
14	TITANIUM TETRACHLORIDE	L	10-21.3	136.4-B																	
15	TOLUENE	L	36.7-30	110.4-B																	
16	TOLUENE DIISOCYANATE	L		118-B																	
17	O-TOLUENE SULPHONIC ACID	S		129-B																	
18	P-TOLUENE SULPHONIC ACID	S		107-M																	
19	O-TOLUIDINE	L	1-44	200-B																	
20	TOXAPHENE (SEE CHLORINATED CAMPHENE)	S		65-B																	
21	SEE INSECTICIDES)																				
22	TRIACETYLENE	S		264-M																	
23	1,2,4-TRIAZOLE	S		94-B																	
24	TRISODIOPHENOL	L	0.03-150	200-B																	
25	TRIBUTYL METHYL PHOSPHATE	L		212-B																	
26	TRI-N-BUTYL AMINE	L		71-B																	
27	TRI-N-PENTYL BORANE	L		230-B																	
28	TRIBUTYL BORATE	L		209-B																	
29	TRIBUTYL PHOSPHATE	L																			
30	TRI-N-BUTYL TIN ACETATE																				
31	TRICHLOROXYLIN HYDROXIDE (ALSO PLICTRAN)																				
32	1,2,4-TRICHLOROBENZENE	L	1-38.4	213-B																	
33	1,1,1-TRICHLOROETHANE	L	100-20	74.1-B																	
34	1,1,2-TRICHLOROETHANE	L	40-35.2	114-B																	
35	TRICHLOROETHYLENE	L	100-32	87.1-B																	
36	TRICHLOROFLUOROMETHANE	L		24.1-B																	
37	TRICHLOROLAPHTHALENE	S																			
38	3,4,6-TRICHLORO-1-NITROPHENOL	S		58-M																	
39	2,4,6-TRICHLORO-3-NITROSALICYLANILIDE																				
40	2,4,6-TRICHLOROPHENOL (SEE BIOCIDES)	S	1-72	252-B																	
41	1,2,3-TRICHLOROPROPANE	L		142-B																	
42	TRICHLOROTOLUENE	L		214-B																	
43	TRICHLOROTRIFLUOROETHANE	L		45.2-B																	
44	TRICRESYL PHOSPHATE	L		410-B																	
45	TRICYCLOHEXYL BORATE	S		56-M																	
46	TRIDECYL ALCOHOL	L		252-B																	
47	TRIDECYL BENZENE	L																			
48	TRIDECYL (ETHOXY) PHOSPHORIC ACID																				
49	TRIETHANOLAMINE	L	10-205	360-B																	
50	TRIETHYLALUMINUM	L	4-63	194-B																	
51	TRIETHYLAMINE	L		89.5-B																	
52	TRIETHYLENE GLYCOL	L	1-114	291-B																	
53	TRIETHYLENE GLYCOL MONOBUTYL ETHER	L		-0																	
54	TRIETHYLENE GLYCOL MONOETHYL ETHER																				

COMPOUND NAME	PHYSICAL-PROPERTIES			TLV-TWA-CAR				TOXIC-TEST-DATA					ODOUR-INFO PHY O-RAT QUANTITY							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TRIETHYLENE GLYCOL MONOMETHYL ETHER	L		249-B																	
TRIETHYLENE TETRAMINE	L	0.01-20	278-B					4340-K-LD50-ORL-RAT-4										4340		
TRI (2-ETHYLHEXYL) TRIMELLITATE																				
TRIETHYLSTIBINE (SEE ANTIMONY TRIETHYL)	L		159.5-B																	
TRIFLUPROMAZINE HYDROCHLORIDE	S		173-D					0.29-K-TCLD-ORL-HMN-4												
2-TRIFLUOROMETHYL-4-NITROPHENOL								40-K-LCLD-IPR-MUS-4												
TRIFLUOROMONOBROMOMETHANE				6100	1															
A,A,A-TRIFLUORO-4-NITRO-P-CRESOL																				
TRIFLUOROTRICHLOROETHANE	G		-46-B												U-521.00- 8					
TRIIODOPHENOL	S																			
TRIISOBUTYLALUMINUM	L	1-47	-D																	
TRIISOOCTYL TRIMELLITATE	L		275-D																	
TRIISOPROPANOLAMINE	S	0.01-20	45-M					1080-K-LD50-ORL-GPG-4												
TRIISOPROPYL BORATE	L		141-B					2500-K-LD50-ORL-MUS-4												
TRIETHOXYBENZENE																				
TRIMETHYLAMINE	G		2.9-B					75-K-LDLO-IPR-MUS-4	R-.00051- 6											
1,2,4-TRIMETHYLBENZENE				120	1			2000-K-LDLO-IPR-RAT-4												
2,2,4-TRIMETHYL (3-PHENYLISOPROPYL)-1,2-DIHYDROQUINOLINE																				
TRIMETHYL AND TRIMETHYLOCTADECADIENYL AMMONIUM CHLORIDES																		I- 445		
TRIMETHYLOLETHANE	S																			
TRIMETHYLSTIBINE (SEE ANTIMONY TRIMETHYL)	L		80.6-B					1370-K-LDLO-SCU-CAT-4												
2,3,5-TRINITROBENZAMIDE																				
TRINITRORESORCINOL	S		180-M																	
TRINITROTOLUENE	S		80.7-M	1.5	1			700-K-LDLO-ORL-RAT-4												
TRIOORTHOCRESYL PHOSPHATE				0.1	1			3000-K-LD50-ORL-RAT-4										3000		
TRIPHENYLBORATE	S		35-M					200-K-LD50-ORL-MUS-4												
TRIPHENYLCHLOROMETHANE																				
TRIPHENYL PHOSPHATE	S	1-193	48.5-M	3	1			3000-K-LDLO-ORL-RAT-4												
2,3,5-TRIPHENYLTETRAZOLIUM CHLORIDE	S		245-D																	
TRIPHENYLITIN ACETATE				0.1	4			81.3-K-LD50-ORL-MUS-4												
TRIPHENYLITIN CHLORIDE	S		106-M																	
TRI-N-PROPYLAMINE	L		156-B					1490 - LCLD-IHL-RAT-4												
TRIPROPYLENE GLYCOL	L	1-96	267-B					3000-K-LD50-ORL-RAT-4										3000		
TRI-N-PROPYLTIN IODIDE	L		262-B																	
TRISODIUM ETHYLENEDIAMINETETRAACETATE	S																			
TRISODIUM HYDROXYETHYL ETHYLENEDIAMINETRI-ACETATE	L																			
TRISODIUM NITRILOTRIACETATE								681-K-LD50-ORL-MUS-4												
TRITYLTHYMIDINE																				
TRYPAFLAVINE								11-K-LDLO-IPR-MUS-4												
TRYPSIN	S							650-K-LD50-IPR-MUS-4												
TUNG OIL	L		290-F															I- 854		
TUNGSTEN (SOLUBLE)	S	1-3990	3370-M	1	1															
TUNGSTEN (INSOLUBLE)				5	1															
TUNGSTEN TITANIUM CARBIDE																				
TURPENTINE	L		154-B	560	1			420 - TCLD-IHL-HMN-4										U- 1322		
URANIUM AND COMPOUNDS	S		1132-M	0.2	1															
URANYL ACETATE	S		110-M	0.2	4			400-K-LD50-IPR-MUS-4												
URANYL NITRATE	S		60-M																	
URANYL SULPHATE	S		100-D																	
UREA	S		132.7-M																	
UREA FORMALDEHYDE RESINS																		PI-371215		
																		AS- 19035		

COMPOUND NAME		PHYSICAL-PROPERTIES					TLV-TWA-CAR	TOXIC-TEST-DATA										OCCUR-INFO PHY		O-RAT	QUANTITY
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	UREA PHOSPHATE																				
2	UREA SULPHATE																				
3	VALERIC ACID	L		187-B																	
4	VANADIUM PENTOXIDE (FUME)					0.5	1														
5	VANADIUM PENTOXIDE (DUST)	S		690-M		5	1														
6	VANADYL SULPHIDE	S		-D																	
7	VANADYL SULPHATE	S																			
8	VANILLIN	S		81-H																	
9	VINYL ACETATE (MONOMER)	L	100-21.5	73-B		30	1														
10	VINYL BACIDE (ALSO BROMETHYLENE)	G		15.6-G		1100	1														
11	VINYL BUTYRATE	L		118-B																	
12	VINYL CHLORIDE (MONOMER)	G	2600-25	-13.4-B		770	1														
13	VINYLBENZENE	L		31.6-B		40	1														
14	VINYLTOLUENE	L		170-B		480	1														
15	VAREPARIN	S		161-H		0.1	1														
16	VOOR DUST					5	1														
17	XANTHIC ACID	L		22-D																	
18	XANTHINE	G		-107.1-B																	
19	XYLENES	L	10-27.3	118.3-B		440	1														
20	XYLENOL	S	1-52	60-B																	
21	XYLITENE (ALSO AMINODIMETHYLBENZENE)	L		213-B		25	1														
22	YTTRILK	S		1500-K		1	1														
23	ZINC	S	1-487	419.4-B																	
24	ZINC ACETATE	S		242-B																	
25	ZINC AMMONIUM BISULPHITE																				
26	ZINC AMMONIUM CHLORIDE	S																			
27	ZINC ARSENATE	S		100-D																	
28	ZINC ARSENITE	S																			
29	ZINC BOROFLOURIDE																				
30	ZINC CHLORIDE (FUME)	S	1-428	252-B		1	1														
31	ZINC CHROMATE	S																			
32	ZINC CYANIDE	S		800-D																	
33	ZINC DIALLYL DITHIOCARBAMATE	S		104-B																	
34	ZINC DIETHYL DITHIOCARBAMATE	S		172-B																	
35	ZINC DIMETHYL DITHIOCARBAMATE	S		248-B																	
36	ZINC DUST	S	1-487	419.4-B																	
37	ZINC Z-ETHYLENEOXIDE	L																			
38	ZINC HYDROSULPHITE	S		200-D																	
39	ZINC ISOCYANATE																				
40	ZINC LAURATE	S		128-B																	
41	ZINC LIGNOSULPHONATES																				
42	ZINC MERCAPTOUREAZOTHIAZOLE	S		300-H																	
43	ZINC NAPHTHENATE	S																			
44	ZINC NITROCARBONATE																				
45	ZINC NITRATE	S		45.5-H																	
46	ZINC OXIDE (FUME)	S		1800-B		5	1														
47	ZINC PERMANGANATE	S		100-H																	
48	ZINC PEROXIDE	S		150-D																	
49	ZINC SELENIDE	S		1100-H																	
50	ZINC STEARATE	S		130-H		10	1														
51	ZINC SULPHATE	S		740-D																	
52	ZINC SULPHIDE	S		1850-B																	
53	ZINC TALLATE																				
54	ZIRCONIA	S		2700-M																	

05.04 On-going Priority Substances

05.04.01 List of Summaries

Asbestos

Polychlorinated Biphenyls (PCB's)

Vinyl Chloride

ASBESTOS

Physical and Chemical Properties

Asbestos is a generic term which refers to a group of fibrous hydrated silicate minerals of the serpentine and amphibole groups. Customarily included in the definition of asbestos are chrysotile (serpentine); amosite, crocidolite, anthrophyllite, tremolite, and actinolite (all amphiboles). These minerals have complex chemical compositions which distinguish them from one another. The chemical composition changes, sometimes significantly, with exposure to the environment, making it very difficult to identify positively individual fibre types in environmental samples by means of elemental analysis. These properties are discussed in Section 4 of the report "Asbestos as a Hazardous Contaminant" (ARB-TDA-01-75) (Reference 1).

Potential Emission Sources

Sources are discussed in detail in Section 5 of Reference 1.

Health Effects

Asbestos has been occupationally linked with a potentially fatal disease, asbestosis. It was later associated with malignant carcinomas of the lung, gastrointestinal tract, stomach and a very rare cancer of the peritoneum or pleura, mesothelioma. In general, the available data and information are only pertinent to the high concentrations experienced in occupational exposure.

Asbestosis is considered by most authorities to be strictly an occupational hazard requiring at least several years of heavy asbestos exposure to concentrations of fibres well above those found in ambient air.

As most of the clinical experience relates to occupational exposures, there seems to be little evidence of a significant threat of asbestos-induced carcinomas to the health of the general public. Some effects are detectable in occupational environments where overall exposures are minimal, but it seems likely that these exposures are greatly in excess of those in urban communities. Unlike asbestosis, asbestos-related cancers seem to follow no well-defined dose-response and threshold level relationship. Very short exposure to a high concentration of asbestos dust or chronic exposure to a very low concentration may both lead to the induction of cancer after a typically long latent period following first exposure. Therefore, a "safe level" of exposure for either occupational or community cancer risk has not been established. Current data on asbestos-induced carcinomas of the lung seem to indicate that the only portion of the population at risk of cancer are people indirectly exposed to asbestos (i.e. family of asbestos worker or living in the vicinity of a heavily emitting asbestos processing centre).

Mesothelioma, a rare cancer (incidence in Canada: one/million population/year), seems to be the most serious asbestos-induced threat to the health of the general population at this time. Most cases in which environmental data are available have been characterised by potential or actual asbestos exposure, frequently occupational and often that associated with residence within 1/2 mile of an asbestos plant, or within the household of an asbestos worker. These exposures have often been of short duration (weeks to months) with a latency period of 20-30 years.

Early evidence gathered in South Africa and England seemed to implicate one of the several varieties of asbestos fibres, namely crocidolite (blue), as particularly dangerous in inducing mesothelioma. Non-occupationally contracted cases of mesothelioma, involving crocidolite, were identified in these areas. Recently, Selikoff (Mt. Sinai Medical School, New York) found comparable numbers of non-occupationally contracted mesothelioma associated with the amosite (brown) variety of asbestos. Studies involving the chrysotile (white) variety conducted in Canada, Italy, and Cyprus indicate only a few occupational excess deaths due to mesothelioma.

All varieties of asbestos which have been tested are capable of causing epithelial cancers by inhalation, so the question is one of level of exposure, not of ability or inability to act as a carcinogen.

Environmental and Occupational Air Standards

The current Ontario Occupational Health Standard is 2 fibre/cm³ greater than 5 um in length (8-hour TWA). The U.S. Occupational Health Standard was to become 2 f/cm³ (on the same basis as above) by June 1976, but a recent proposal by OSHA sets forth a 0.5 f/cm³ standard (> 5 um length, < 5 um width), promulgation date to be set. The Ontario Ambient Air Quality Guideline is 0.04 f/cm³ (> 5 um in length) averaged over 24 hours. The Provincial Design Guideline is 5 ug/m³ (all fibre lengths) averaged over 30 minutes at a point of impingement. The proposed Environment Canada National Emission Standard for asbestos fibres is 2 f/cm³ (> 5 um in length) at the source to apply only to mining and milling operations. This same standard has been promulgated by the Quebec Government.

The Departments of Health and Welfare and Consumer and Corporate Affairs have announced intent to ban the importation of crocidolite (blue) asbestos and the sale of consumer products containing free asbestos fibres under the authority of the Hazardous Products Act.

Sampling and Analytical Methods

Asbestos fibres in ambient air are sampled on various filter media by methods suitable for airborne particulate matter. Membrane or polymer fibre filters may be used with either high volume or low volume samplers. Polycarbonate or cellulose acetate membrane filters or polystyrene fibre filters have been used successfully to collect asbestos fibres. The currently recommended filter media are polycarbonate membrane or polystyrene fibre filters in 8" X 10" size for use with a high-volume sampler. The sampler should incorporate a feedback electronic flow controller, if possible, because of the restricted flow through membrane filters, especially. The air sample should comprise at least 200 m^3 ($0.7 \text{ m}^3/\text{min.}$ for 4 to 24 hours) on 8" X 10" filters or at least 10 m^3 ($0.05 \text{ m}^3/\text{min}$ for 4 to 24 hours) on 47 mm diameter filter discs.

Analysis of ambient samples must be carried out by electron microscopy and fibre counting techniques for compliance testing with respect to fibre number or mass concentration guidelines. See references (2) and (3) for an evaluation of sampling methods and media.

Control and Abatement Techniques

These techniques are well summarised in reference 1. Reports on asbestos fibre control technology and process

substitutes for asbestos fibres are being prepared by Technology Development and Appraisal Section.

REFERENCES FOR ASBESTOS SUMMARY

File: Approximately 200 articles and reports on all of the above aspects of asbestos.

1. MOE Report, "Asbestos as a Hazardous Contaminant" (ARB-TDA-01-75)
2. MOE Report, "Asbestos as a Hazardous Contaminant, Progress Report I" (ARB-TDA-16-75)
3. MOE Report, "Asbestos as a Hazardous Contaminant, Progress Report II" (ARB-TDA-20-76)

POLYCHLORINATED BIPHENYLS

Physical and Chemical Properties

Polychlorinated biphenyls (PCB's) are normally encountered as mixtures of molecular isomers which have one to ten chlorine atoms per molecule. Current commercial PCB products manufactured in North America are fluid mixtures containing 21, 42, or 54% by weight chlorine. Fully chlorinated biphenyl (decachlorobiphenyl), which is imported from Italy, is a solid composed of 72% chlorine. In addition,

PCB fluid products ranging from 21 to 68% chlorine content are manufactured in many countries.

Aroclor is Monsanto Corporation's trade name for its various PCB mixtures, Monsanto being the only North American manufacturer of PCB's. No PCB's are manufactured in Canada. PCB mixtures or blends of these mixtures with other materials manufactured to certain specifications for use as dielectric media in power transformers or capacitors are called askarels, a generic term covering many different manufacturers' trade names. The composition of askarels currently ranges from essentially 100% PCB's for impregnating & filling capacitors to 45 or 70% PCB's for filling transformers.

Because of their high dielectric strength and thermal stability, PCB's are destroyed completely only by high temperature incineration (1300 C or higher for one second or longer). They are resistant to biological degradation, but the lower chlorinated species can be degraded to some extent by certain activated microbial sludge systems.

The lifetime of PCB's, particularly the isomers

having five or more chlorine atoms per molecule, in air or water is not known but is believed to be very long, that is, of the order of weeks to years. The residence time in the atmosphere appears to be determined by the rate of deposition to land or surface water and not by chemical reactions.

Several studies have demonstrated that there are appreciable concentrations of PCB's in the atmosphere, ranging from about 0.5 ug/1000 m³ over the oceans to approximately 100 ug/1000 m³ in urban areas. Most of the airborne PCB's are in the vapour phase, considerably less than ½ of the measured amounts are found adsorbed onto particulate matter.

Potential Emission Sources

There are practically no source test data for PCB's. The bulk of emissions to the atmosphere is expected to occur from capacitor and transformer filling facilities, evaporation losses from these electrical components in the field, municipal waste and sewage sludge incinerators, and from older PCB-filled heat exchangers and hydraulic systems, especially in refinery and metal stamping operations.

Although PCB's are virtually restricted to use in closed electrical component, their former applications in many other products and pieces of equipment continue to provide reservoirs for potential emissions to the atmosphere. PCB's may appear in waste oil supplies and in plastic and paper products in which they had been used as plasticizers.

Source testing for PCB's is currently a high priority programme within the Air Resources Branch.

Health Effects

PCB's have caused the following toxic effects in humans: chloracne, pigmentation of skin and nails, eye irritation and swelling, digestive disturbances, edema (inflammation) of face and hands. The level of exposure which would induce the above symptoms is undoubtedly considerably greater than that which is possible through strictly environmental exposure. The "Yusho" incident in Japan, in which rice oil for human consumption was contaminated by PCB's (1,500 to 2,000 ppm) from a leaking heat exchanger has recorded more than 1,200 victims who have been severely disabled by symptoms such as those listed above. Some effects were not reversible after exposure was discontinued.

Neoplastic and tumorigenic effects have been observed in human victims of PCB poisoning, and several species of mammals, including primates, have developed liver cancers and other neoplasms from ingesting relatively low levels of PCB's in the diet. These levels are generally well above those to which humans would be exposed outside of the working place.

Because of their high solubility in fatty tissue and their resistance to metabolism, PCB's accumulate from the environment into biological systems. For example, certain species of fish can concentrate PCB's in their fatty tissue to several hundred thousand times the level in the surrounding water. This means that 10 parts per trillion of PCB in water can become 2 parts per million in fish tissue, which may then be consumed by animals

higher in the food chain, including man. At least one poisoning incident among mink fed fish from PCB contaminated water has been attributed to this cause.

Environmental and Occupational Air Standards

There are no regulations in Canada or elsewhere on PCB concentrations in ambient air. The current U.S. Occupational Health Standard is 1 mg/m^3 for PCB containing 42% chlorine and 0.5 mg/m^3 for PCB containing 54% chlorine. PCB's are being considered for regulation by Environment Canada under the new Environmental Contaminants Control Act.

Sampling and Analytical Methods

Vapour-phase and particulate polychlorinated biphenyls can be sampled by a standard EPA (or equivalent) impinger sampling train. Ethylene glycol has been shown to be an appropriate impinger absorbent. Because of the predominance of PCB's in the vapour phase, high volume filter samples are not representative of total airborne PCB's.

Work is underway to develop and test a solid absorbent cartridge sampler for general purpose organic vapour sampling which should be appropriate for sampling PCB's.

The sensitivity of the impinger sampling method for a sample of about 200 m^3 of air is less than one $\mu\text{g}/1000 \text{ m}^3$. The sensitivity and required sample volume of the solid adsorbent system have not been evaluated.

PCB determinations are performed by gas chroma-

tography or combined gas chromatography/mass spectrometry. The Trace Organic Contaminants Laboratory, Laboratory Services Branch, is equipped to carry out such analyses.

Control and Abatement

No information is available on specific control and abatement equipment for PCB's. Typical oil mist control equipment may be useful in cleaning the exhaust from vacuum systems, but good maintenance practice and restricted disposal of waste PCB's will probably contribute most to abatement of PCB emissions.

REFERENCES FOR PCB SUMMARY

File: Approximately 75 references on all aspects of PCB's except control and abatement.

- 1) N. Nelson (Panel on Hazardous Trace Substances), "PCB's - Environmental Impact," Environmental Research, Vol. 5, pages 249-362 (1972).
- 2) D.B. Peakall, "PCB's and their Environmental Effects", CRC Critical Reviews in Environmental Control, Sept. 1975, pages 469-508.
- 3) O. Hutzinger, S. Safe, and V. Zitko, "The Chemistry of PCB's", CRC Press, Cleveland, Ohio, 1974.

VINYL CHLORIDE

Physical and Chemical Properties

Vinyl chloride (chloroethene, chloroethylene, vinyl chloride monomer) is a colourless gas which boils at -13.8C. It has a faintly sweet odour and an odour threshold variously reported as 250-270, 400 and 4100 ppm, depending upon the inhibitor content and upon the degree of prior exposure.

More detailed properties appear on pages 2-7 of the MOE background report, "Vinyl Chloride as an Airborne Hazardous Contaminant" (Reference 1).

In the atmosphere VCM behaves as a reactive hydrocarbon with respect to nitrogen oxides and oxidants. VCM is slightly less reactive (about 2/3) than ethylene in air which is polluted by amounts of NO_x which are typical of urban or industrialised areas. The lifetime of VCM in the atmosphere under typical conditions is about one day. The major reaction products of VCM atmospheric degradation are formic acid, hydrogen chloride, carbon monoxide, formaldehyde and ozone, all of which are undesirable pollutants in the troposphere since they are irritant or corrosive substances. Almost all of the chlorine from the VCM ends up in the form of HCl under these conditions.

Potential Emission Sources

The three major categories of vinyl chloride monomer (VCM) atmospheric emission sources are VCM production facilities, polyvinyl chloride (PVC) production facilities, and PVC product fabrication facilities. Pages 8-23 of reference 1 treat these potential emissions in detail.

References 2, 3, and 4 are MOE reports concerning ambient air surveys for VCM which have been conducted by the Air Resources Branch near sources.

On the basis of these surveys, the PVC resin manufacturing plants have been identified as the major VCM emitters, closely followed by the lone VCM manufacturing plant. Although the survey of fabricating plants was cursory at best, it appears that VCM emissions are not a problem at these locations, especially since the resin manufacturers are reducing the residual monomer content of the shipped PVC to very low levels (10 ppm by weight or less for most grades).

Health Effects

The statement which appears on page 48 of reference 1 in October 1974 is still true, namely; "There is no substantial body of information relating to the effects of community exposure to vinyl chloride monomer". In fact, to date, there are no documented environmental health effects on humans associated with exposure to vinyl chloride monomer outside of the work place.

Health effects of VCM in occupational situations are described on pages 43-50 of reference 1. More detailed discussions of VCM-PVC appear in "Toxicity of Vinyl Chloride -Polyvinyl Chloride", reference 5.

The prime concern with respect to environmental exposure to VCM is its carcinogenicity. At concentrations of VCM greater than 50 ppm in inhaled air, test animals have developed angiosarcomas (malignancies) of the liver, in addition to other neoplastic (benign or malignant) disorders.

Carcinogenic effects of vinyl chloride appear to follow dose-response relationships at the lower experimental exposure levels (50 to 500 ppm), but there are no dose-response data for levels of 1 ppm and lower which would be found in ambient air. Studies of the large numbers of test animals which are required to detect low incidences of disease at these concentrations are underway in Italy and elsewhere, but human epidemiological data relative to low level ambient exposure are unlikely to be available for several decades.

Health effects of PVC dust have not been studied thoroughly, either in occupational or environmental exposure settings. Fine PVC dust is emitted by resin manufacturers and secondary fabricators and might possibly present an inhalation problem by transporting the entrapped VCM residue directly into the lung. PVC dust apparently also acts as a respiratory irritant in its own right.

Environmental and Occupational Air Standards

The Ontario Occupational Health Standard for vinyl chloride monomer for TWA eight hour exposure is 10 ppm (by volume) or 28 mg/m³. The current Ontario 24-hour average ambient air quality guideline is 0.1 ppm (280 ug/m³), and the ½-hour average design guideline is 0.2 ppm (560 ug/m³) at a point of impingement.

The corresponding U.S. Occupational Health Standard is 1 ppm (3 mg/m³) TWA over 8 hours, not to exceed a ceiling value of 5 ppm. The proposed U.S. EPA emission standard for VCM specifies certain process parameters and limits

stack (or other point source) emissions to 10 ppm maximum (reference 6).

Germany has a TLV for vinyl chloride of "no permissible expose", while Sweden uses a TLV of 1ppm (3mg/m^3) as in the U.S.

The basis for all of these standards is human health effects: carcinogenicity and to some extent cardiovascular system effects (at higher concentrations).

Sampling and Analytical Methods

These methods are set forth on pages 31-37 and in Appendix II of reference 1. Recommended sampling procedure at present is to draw a known volume of air through an activated charcoal filled cartridge which removes the vinyl chloride gas. In the laboratory, the vinyl chloride is desorbed from the charcoal adsorbent by cold carbon disulphide. This process is >90% efficient. An aliquot of the vinyl chloride/ CS_2 solution is injected into a gas chromatograph for quantitation. The overall sensitivity of this sampling and analysis procedure is about 0.003 ppm (3ppb) in the original air sample.

Alternatively, samples of air to be analysed for vinyl chloride may be collected in aluminized Mylar multi-layer plastic bags, either as grab samples, or as integrated samples by slowly pumping in air over several hours. Other types of plastic bags (including Tedlar) have been found to be unsuitable for low-level VCM measurements.

Control and Abatement

Control technology is discussed on pages 24-30 of reference 1. The most significant recent development is

vacuum steam stripping with closed cycle recovery of VCM from the PVC resin slurry. Other segments of the PVC production process can also be equipped with monomer recovery plumbing, which combined with good preventive maintenance (of pump seals, etc.) can greatly reduce fugitive emissions.

TDA is to issue a report on VCM control technology in 1976.

REFERENCES FOR VINYL CHLORIDE SUMMARY

1. "Vinyl Chloride as an Airborne Hazardous Contaminant", ARB-TDA-01-74.
2. "Survey of Vinyl Chloride Monomer Concentrations in Ambient Air Near the Esso Chemical Polyvinyl Chloride and Dow Chemical VCM Plants in Sarnia, Ontario during Sept., Oct. and November 1974," ARB-TDA-02-75.
3. "Report on Ambient Air Quality Survey of B.F. Goodrich Chemical of Canada Ltd., Niagara Falls, May 6-May 15, 1975", ARB-TDA-09-75.
4. "Report on Ambient Air Quality Survey of Selected Fabricators of Polyvinyl Chloride Resin Products, June 24-Sept. 30, 1975." ARB-TDA-11-75.
5. "Toxicity of Vinyl Chloride-Polyvinyl Chloride", Annals of the New York Academy of Sciences, Vol. 246, pages 1-337, 1975.
6. "Proposed Standard for Vinyl Chloride", U.S. Environmental Protection Agency, U.S. Federal Register, vol. 40, No. 248, pages 59532-59552, December 24, 1975.

05.05 Hazardous Substances Data Sheets

05.05.01 REFERENCES FOR DATA SHEETS

GENERAL:

- (1) "Data Base Compilation for Ontario Ministry of the Environment Hazardous Airborne Substances Study," James F. MacLaren Limited, February, 1976.
- (2) "Hazardous Polluting Substances in the Lower Great Lakes," A report to Environment Canada, James F. MacLaren Limited, March, 1974.
- (3) A.W. Gnyp et al., An Information Search and Evaluation of Properties, Potential Sources, Levels of Atmospheric Emissions and Environmental Effects of Exotic Air Pollutants, The Industrial Research Institute of the University of Windsor, September, 1973.

I PROPERTIES:

- (4) G.G. Hawley (Revis.), The Condensed Chemical Dictionary, 8th ed., Van Nostrand Reinhold Company, New York, N.Y., 1971.
- (5) R.C. Weast (ed.), Handbook of Chemistry and Physics, 51 st. ed., Chemical Rubber Company, Cleveland, Ohio, 1970.
- (6) P.G. Stecher (ed.), The Merck Index, 8th ed., Merck and Company Incorporated, Rahway, New Jersey, 1968.
- (7) D.M. Considine, Chemical and Process Technology Encyclopedia, McGraw Hill Incorporated, 1974.

II HEALTH EFFECTS:

- (8) N.I. Sax, Dangerous Properties of Industrial Materials, 4th ed., Van Nostrand Reinhold Company, New York, N.Y., 1975.
- (9) Documentation of the Threshold Limit Values for Substances in Workroom Air, 3rd ed., American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 1971.
- (10) M.N. Gleason et al., Clinical Toxicology of Commercial Products, Acute Poisoning, 3rd ed., The Williams and Wilkins Company, Baltimore, Maryland, 1969.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

- (11) "Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1974," American Conference of Governmental Industrial Hygienists, 1974.
- (12) Registry of Toxic Effects of Chemical Substances, 1975 ed., U.S. Department Of Health, Education, and Welfare, National Institute for Occupational Safety and Health, Rockville, Maryland, June, 1975.
- (13) Work Hazard: Threshold Limit Values for Chemical Agents in the Workplace, International Occupational Health Conference, 1975.

- (14) The Environmental Protection Act, 1971, Regulation 15, Ontario Regulation 872/74, Schedule 1 and the Ambient Air Quality Criteria Schedule, December, 1974.

IV COMMENTS:

- (15) Reference 2.
- (16) Kirk-Othmer Encyclopedia of Chemical Technology, 2nd ed., John Wiley and Sons Inc., New York, N.Y., 1968.
- (17) Reference 7.

The following system of toxicity ratings is used to indicate the relative hazard:

U = Unknown

This rating has been assigned to chemicals for which insufficient toxicity data were available to enable a valid assessment of hazard to be made. These compounds usually are in one of the following categories:

(a) No toxicity information could be found in the literature and none was known to the authors.

(b) Limited information based on animal experiments was available but in the opinion of the authors this information could not be applied to human exposures. In some cases this information is mentioned so that the reader may know that some experimental work has been done.

(c) Published toxicity data were felt by the authors to be of questionable validity.

0 = No Toxicity

This designation is given to materials which fall into one of the following categories:

(a) Materials which cause no harm under any conditions of normal use.

(b) Materials which produce toxic effects on humans only under the most unusual conditions or by overwhelming dosage.

1 = Slight Toxicity

(a) *Acute local.* Materials which on single exposures lasting seconds, minutes, or hours cause only slight effects on the skin or mucous membranes regardless of the extent of the exposure.

(b) *Acute systemic.* Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which produce only slight effects following single exposures lasting seconds, minutes, or hours, or following ingestion of a single dose, regardless of the quantity absorbed or the extent of exposure.

(c) *Chronic local.* Materials which on continuous or repeated exposures extending over periods of days, months, or years cause only slight and usually reversible harm to the skin or mucous membranes. The extent of exposure may be great or small.

(d) *Chronic systemic.* Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which produce only slightly usually reversible effects following continuous or repeated exposures extending over days, months, or years. The extent of the exposure may be great or small.

In general, those substances classified as having "slight toxicity" produce changes in the human body which are readily reversible and which will disappear following termination of exposure, either with or without medical treatment.

2 = Moderate Toxicity

(a) *Acute local.* Materials which on single exposure lasting seconds, minutes, or hours cause moderate effects on the skin or mucous membranes. These effects may be the result of intense exposure for a matter of seconds or moderate exposure for a matter of hours.

(b) *Acute systemic.* Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which produce moderate effects following single exposures lasting seconds, minutes, or hours, or following ingestion of a single dose.

(c) *Chronic local.* Materials which on continuous or repeated exposures extending over periods of days, months, or years cause moderate harm to the skin or mucous membranes.

(d) *Chronic systemic.* Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which produce moderate effects following continuous or repeated exposures extending over periods of days, months, or years.

Those substances classified as having "moderate toxicity" may produce irreversible as well as reversible changes in the human body. These changes are not of such severity as to threaten life or produce serious physical impairment.

3 = Severe Toxicity

(a) *Acute local.* Materials which on single exposure lasting seconds or minutes cause injury to skin or mucous membranes of sufficient severity to threaten life or to cause permanent physical impairment or disfigurement.

(b) *Acute systemic.* Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which can cause injury of sufficient severity to threaten life following a single exposure lasting seconds, minutes, or hours, or following ingestion of a single dose.

(c) *Chronic local.* Materials which on continuous or repeated exposures extending over periods of days, months, or years can cause injury to skin or mucous membranes of sufficient severity to threaten life or cause permanent impairment, disfigurement, or irreversible change.

(d) *Chronic systemic.* Materials which can be absorbed into the body by inhalation, ingestion or through the skin and which can cause death or serious physical impairment following continuous or repeated exposures to small amounts extending over periods of days, months, or years.

* H.I. Sax, Dangerous Properties of Industrial Materials, 4th ed., Van Nostrand Reinhold Company, New York, N.Y., 1975, Chapter 9.

ACETALDEHYDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25 ⁰ C) -	
Chemical Formula -	CH ₃ CHO
Molecular Weight -	44.1
Boiling Point -	20.8 C
Melting Point -	-123.5 C
Solubility in Water -	Soluble
Additional Information -	
- Synonyms: Acetic Aldehyde, Ethyl Aldehyde, Ethanal	
- Colourless fuming liquid at 20 C	
- Pungent fruity odour	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	2	

Additional Information -

- A local irritant. Potential injury to respiratory tract. Effects are narcosis, bronchitis, albuminuria, fatty liver and lung edema.
- Inhalation does not cause chronic poisoning. But large doses may cause death by respiratory paralysis.
- Less irritating but stronger central nervous system depressant than formaldehyde.

ACETALDEHYDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 180,000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	200	360,000
Sweden	50	90,000

D. Additional Information:

- U.S. TLV of 100 ppm is adopted to prevent excessive eye irritation and potential injury to the respiratory tract
- Soviet TLV (1966) 3 ppm
- U.S. Occupational Standard: time weighted average 200 ppm

IV

COMMENTS

- Generally used in organic chemical industry as an intermediate for other products.

ACETIC ACID (GLACIAL)

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25 ⁰ C) -	15.4 mm Hg
Chemical Formula -	CH ₃ COOH
Molecular Weight -	60.1
Boiling Point -	118.1 C
Melting Point -	16.7 C
Solubility in Water -	Miscible in all proportions in water.
Additional Information -	
- Synonyms: Ethanoic Acid, Vinegar Acid, Methane Carboxylic Acid	
- Clear, colourless liquid	
- Pungent odor	
- Glacial acetic acid is the pure compound (99.8% min) as distinguished from the usual water solutions known as acetic acid (e.g., vinegar)	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	3
Acute Systemic -		
Chronic Local -		2
Chronic Systemic -		

Additional Information -

- Caustic, irritating to tissue
- Breathing of concentrated vapours is harmful to lung tissue. Harmless in dilute solutions as in vinegar.
- Can cause severe skin burns, dermatitis, and skin ulcers
- Damages the eyes, possibly causing total blindness in concentrated solution.

ACETIC ACID (GLACIAL) (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 2500 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 10 ppm; 25000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. <u>Occupational Standards (TLV) Elsewhere:</u>		
	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	10	25000
Sweden	10	25000

D. Additional information:

- The Soviet TLV (1966) was 2 ppm
- U.S. TLV of 10 ppm is recommended to prevent undue irritation

IV COMMENTS

- Used in manufacture of plastics and resins, textiles, and leather, pharmaceuticals, pigments, photographic chemicals.
Also used as food additive.

ACETONITRILE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	88.3 mm Hg
Chemical Formula -	CH ₃ CN
Molecular Weight -	41.1
Boiling Point -	80.1 C
Melting Point -	- 41 C
Solubility in Water -	Very Soluble
Additional Information -	
<ul style="list-style-type: none">- Synonyms: Methyl Cyanide, Ethanenitrile- Colourless, limpid liquid. Strongly reactive.- Aromatic odor.- Also soluble in alcohol- Acetonitrile emits highly toxic fumes of cyanides when heated to decomposition.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	1	
Additional Information -		
<ul style="list-style-type: none">- Somewhat less toxic than hydrogen cyanide.		

ACETONITRILE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

40 ppm; 70000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	40	70000

Sweden

D. Additional information:

- A TLV of 40 ppm is recommended to protect against organic cyanide poisoning and injury to respiratory tract.

IV

COMMENTS

- Used in manufacture of pharmaceuticals and medicines.
- Used as a solvent in hydrocarbon extraction processes especially for butadiene.

2 - ACETYLAMINOFLUORENE

I PROPERTIES

Physical State (ambient temp.) - S

Vapour Pressure (25°C) -

Chemical Formula - $\text{CH}_3\text{CONH}(\text{C}_6\text{H}_4\text{CH}_2\text{C}_6\text{H}_4)$

Molecular Weight - 224

Boiling Point -

Melting Point - 194C

Solubility in Water - insoluble

Additional Information -

- synonyms: 2-Acetaminofluorene, Acetyl Amino Phenathrene, N-fluoren-2-ylacetamide, 2-acetamidofluorene, N-acetyl-2-aminofluorene
- crystalline powder
- soluble in alcohol

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- highly toxic. A demonstrated (experimental) carcinogen
- recognized as a carcinogen by OSHA (U.S.), and Sweden
- Contact by all routes should be avoided

2- ACETYLAMINOFLUORENE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV. INDUSTRIAL SECTORS AND POTENTIAL SOURCES:

- An insecticide.

ACRYLAMIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	0.1 mm Hg
Chemical Formula -	$\text{CH}_2\text{CHCONH}_2$
Molecular Weight -	71.08
Boiling Point -	125 C
Melting Point -	84.5 C
Solubility in Water -	Soluble
Additional Information -	
- White, crystalline, odorless solid	
- Also soluble in alcohol and acetone. Insoluble in benzene.	
- Emits acid fumes when heated.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -	2	

- Additional Information -
- Highly toxic by ingestion and inhalation. Strong skin and eye irritant. Can be absorbed through unbroken skin.
 - Produces toxic effect upon central nervous system. Signs of poisoning include general muscular weakness, ataxia, and tremors. In mild cases, toxic effects are quickly reversible if exposure is terminated.

ACRYLAMIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design
Standard: 45 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 300 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- Used as a reactive monomer and intermediate in production of organic chemicals.
- Used as polymer or copolymer in adhesives, fibers, plastics, and resins.
- Used in manufacture of paint and varnish, pigments and dyes.
- Used in waste water treatment, and in the textile and leather industries.

ACRYLONITRILE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	107 mm Hg
Chemical Formula -	CH ₂ CHCN
Molecular Weight -	53.1
Boiling Point -	77.3 C
Melting Point -	-82 C
Solubility in Water -	Partially miscible

Additional Information -

- Synonyms: Propene Nitrile, Vinyl Cyanide
- Colourless, mobile liquid
- Mild odor
- Soluble in all common organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	1	

Additional Information -

- Toxic by inhalation, ingestion, skin absorption.
- Symptoms similar to hydrogen cyanide poisoning (HCN) except less severe. Symptoms include headache, nausea, vomiting, and diarrhea. Also causes irritation of eyes, nose, and respiratory tract. Symptoms disappear after acute vapor exposure is terminated.

ACRYLONITRILE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design Standard:
2200 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 20 ppm; 45,000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	20	45,000

Sweden

D. Additional Information:

- a TLV of 20 ppm is recommended on the basis of animal exposure data, and by analogy with the 10 ppm value for hydrogen cyanide.

IV

COMMENTS

- Used as an intermediate in manufacture of acrylic fibers, acetonitrile - based plastics, nitrile rubber, insecticides, and other products of organic synthesis.

4- AMINOBIIPHENYL

I PROPERTIES

Physical State (ambient temp.) - S
Vapour Pressure (25°C) -
Chemical Formula - $C_6H_5C_6H_4NH_2$
Molecular Weight - 169.2
Boiling Point - 302C
Melting Point - 53C
Solubility in Water - slightly soluble

Additional Information -

- synonyms: p - aminodiphenyl, p-biphenylamine, xenylamine, p-phenylaniline, 4-aminodiphenyl
- colorless crystals
- soluble in alcohol, chloroform

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -	3	
Chronic Local -		1
Chronic Systemic -	3	

Additional Information -

- effects resemble those of Benzidine. Highly toxic by ingestion, inhalation, skin absorption
- has caused bladder cancer in humans and experimental animals
- recognized as a carcinogen by OSHA (U.S.), Germany, Sweden
- contact by all routes of exposure should be avoided.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV COMMENTS

- Used in the detection of sulfates.

AMMONIA

I PROPERTIES

Physical State (ambient temp.) - G
Vapour Pressure (25°C) - 7400 mm Hg
Chemical Formula - NH_3
Molecular Weight - 17.0
Boiling Point - -33.4 C
Melting Point - -77.7 C
Solubility in Water - Very Soluble

Additional Information -

- Colourless, alkaline gas
- Sharp, intensely irritating, pungent odor
- Also soluble in alcohols and organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -		
Chronic Local -		1
Chronic Systemic -		

Additional Information -

- Irritant, primarily to eyes, nasal passages, throat, Becomes very corrosive in aqueous solution, as occurs when contact is made with respiratory mucous membranes. Can cause pulmonary edema.
- Irritation of skin, especially if it is moist
- Permanent damage to eyes, throat, and upper respiratory tract at 400-700 ppm
- Acts as an asphyxiant at high concentrations (greater than 2500 ppm)

AMMONIA - (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 3600 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 25 ppm; 18000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	50	35000
Sweden	25	18000

D. Additional Information:

- U.S. Occupational Standard : 50 ppm (time weighted average)
- TLV of 25 ppm selected to protect against irritation to eyes and the respiratory tract
- Soviet TLV (1967) 15 ppm
- Czechoslovakia TLV (1969) 30 ppm

IV

COMMENTS

Pulp and paper, fertilizers, petroleum refining, water treatment industrial gases, chlor-alkali process, iron and steel industry, cleaning (household and industrial), explosives, food and beverage industry, pulp and paper, textiles (rayon and nylon), rubber.

AMMONIUM CHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1 mm Hg at 160.4 C
Chemical Formula -	NH ₄ Cl
Molecular Weight -	53.5
Boiling Point -	520 C
Melting Point -	
Solubility in Water -	Soluble, up to 27.1 g in 100 g H ₂ O
Additional Information -	
- Synonym: Sal Ammoniac	
- White crystals	
- Slightly soluble in alcohol	
- Sublimes at 340 C	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -		
Chronic Local -		1
Chronic Systemic -		

Additional Information -

- Fume is toxic by inhalation. Large doses cause nausea, vomiting.
- In lower concentrations, it is a mild irritant to skin and respiratory passages.

AMMONIUM CHLORIDE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 10,000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- TLV of 10 mg/m^3 selected to prevent irritation of the respiratory passages.

IV

COMMENTS

- Battery manufacturing, rubber, plating, pharmaceuticals and medicine, plastics and synthetic resins, fertilizers.
- Large amounts of ammonium chloride fume are frequently evolved in galvanizing operations.

ANILINE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	1 mm at 34.8 C
Chemical Formula -	$C_6H_5NH_2$
Molecular Weight -	93.12
Boiling Point -	184.4 C
Melting Point -	- 6.2 C
Solubility in Water -	Soluble

Additional Information -

- Synonyms: Aminobenzene, Phenylamine, Aniline Oil, Aminophen
- colorless, oily liquid; rapidly becomes brown on exposure to light and air
- characteristic odor and burning taste
- soluble in alcohol and most organic solvents. Volatile with steam.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- highly toxic by ingestion, inhalation, and skin absorption
- aniline acts on the hemoglobin of the blood to reduce its oxygen-carrying capacity
- it acts as a depressant of the central nervous system
- long-term exposures affect the blood, and possibly the liver and bladder
- it is an allergen and mild sensitizer. Local contact may cause dermatitis
- aniline has not been proven to be a carcinogen. But the intermediates, benzedine and naphthylamine, have been incriminated.

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 5 ppm; 19000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	5	19000

Sweden (skin)	5	19000
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D. Additional Information:

- U.S. TLV of 5 ppm is adopted to prevent effects on hemoglobin (formation of methemoglobin)
- Soviet TLV (1966) 1 ppm
- Czechoslovakia TLV (1969) 1.3 ppm

IV

COMMENTS

- Aniline is one of the most important of the organic bases. Used as parent substance for many dyes and drugs
- widely used in industry as an intermediate in chemical synthesis
- used in vulcanizing rubber

ANTIMONY AND ANTIMONY COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Antimony	Sb	121.75	S		1635	630.5	
Potassium Tartrate	KSbC ₄ H ₄ O ₇ · 1/2 H ₂ O	333.94	S				
Trichloride	SbCl ₃	228.11	S		283	73.4	V. SOL
Trioxide	Sb ₂ O ₃ or Sb ₄ O ₆	291.50	S		1550	656	SL.SOL
Stibine	SbH ₃	124.8	G		-17	-88	SL.SOL

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	3	

Additional Information -

- recognized as a skin irritant. Sb dust causes eczema and dermatitis, Irritative to eyes
- inhalation of Sb compounds causes inflammation of respiratory tract (pneumonitis, laryngitis, tracheitis). Also causes perforation of nasal septum
- Medicinal treatment of antimony potassium tartrate may cause cardiac disturbances and injury
- animal experiments show cardiac injury
- gaseous stibine (SbH₃), like arsine, is highly toxic by inhalation.

ANTIMONY AND ANTIMONY COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

all forms: 75 ug/m^3
(as Sb)

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Sb and compounds: 500 ug/m^3 (as Sb)
Stibine (SbH_3): 0.1 ppm; 500 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

		(ppm)	(ug/m^3)
West Germany	Sb and Compounds:	—	500 (as Sb)
	Stibine (SbH_3):	0.1	500
Sweden	Sb and Compounds:	—	500 (as Sb)
	Stibine:	0.05	250

D. Additional Information:

Antimony and Compounds

- U.S. TLV OF 500 ug/m^3 is adopted on basis of human response

Stibine

- U.S. TLV of 0.1 ppm is adopted on basis of analogy with Arsine

IV

COMMENTS

- Used in various alloys
- Used in following industries: glass and ceramics, rubber, paints and abrasives, semiconductor electronics.

ARSENIC AND ARSENIC COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. mm Hg	B.P. C	M.P. C	Sol In H ₂ O
Arsenic	As	74.92	S			Subl. 613	INSOL.
Trioxide	As ₂ O ₃ or As ₄ O ₆	197.84	S	0.06		315	SOL.
Trisulphide	As ₂ S ₃	246.04	S				SL. SOL
Arsine	AsH ₃	77.93	G		-55	-113.5	SL. SOL

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	3	

Additional Information -

- inhalation of As dust causes bronchitis, irritation of upper respiratory tract, and perforation of nasal septum
- cutaneous absorption of airborne As. compounds causes skin irritation and dermatitis
- chronic exposure (inhalation, ingestion) causes disturbances of digestive system, blood, and nervous system, liver and kidney damage, pigmentation and ulceration of skin
- a recognized carcinogen (officially in Germany and Sweden) of skin, lungs, and liver. An experimental (animal) carcinogen.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -	Arsenic:	15 $\mu\text{g}/\text{m}^3$
	Arsine	10 $\mu\text{g}/\text{m}^3$
Average Concentration over 24 hours -	Arsenic:	5 $\mu\text{g}/\text{m}^3$

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -	Arsenic, inorganic compds.	250 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -	Arsine: 0.05ppm;	(as As) 200 $\mu\text{g}/\text{m}^3$

C. Occupational Standards (TLV) Elsewhere: ppm

West Germany	Arsine:	0.05	200 $\mu\text{g}/\text{m}^3$
Sweden	Arsenic and Compounds -		500
	Arsine:	0.01	50

D. Additional Information:Arsenic and Compounds

- Soviet TLV (1966) 300 $\mu\text{g}/\text{m}^3$
- Czechoslovakia TLV (1969) 300 $\mu\text{g}/\text{m}^3$
- U.S. Occupational Standard: time weighted average 500 $\mu\text{g}/\text{m}^3$

Arsine

- Soviet TLV (1966) 0.1 ppm
- Czechoslovakia TLV (1969) 0.06 ppm

IV

COMMENTS

- major use of arsenic is in form of trioxide for pesticides and herbicides
- three major sources of arsenic air pollution are -
 - (i) smelting of metals (copper, lead, cobalt, gold)
 - (ii) burning of coal
 - (iii) use of arsenic compounds as pesticides
- arsine is generated in various operations (pickling of metals containing arsenic, soldering, etching, plating) which involve emission of hydrogen in presence of arsenic compounds.

ASPHALT

I PROPERTIES

Physical State (ambient temp.) - S

Vapour Pressure (25°C) -

Chemical Formula - C_nH_n

Molecular Weight -

Boiling Point - < 470 C

Melting Point -

Solubility in Water - Insoluble

Additional Information -

- Synonyms: bitumen, petroleum pitch
- black or dark brown mass
- pitch-like odour
- soluble in petroleum, carbon disulphide, oil turpentine, acetone, and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -		
Chronic Local -		2
Chronic Systemic -		
Additional Information -		
- Specific health effects, particularly a carcinogenic potential, have not been definitely established.		

ASPHALT (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (fumes) 5000 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

BARIUM AND BARIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Barium	Ba	137.34	S		1140	725	
Acetate	Ba(C ₂ H ₃ O ₂) ₂	255.43	S				V.SOL.
Carbonate	BaCO ₃	197.35	S				SOL.
Chloride	BaCl ₂	208.25	S		1560	925	SOL.
Chromate	BaCrO ₄	255.33	S				
2-Ethylhexoate							
Ferrite							
Hydroxide	Ba(OH) ₂ ·8H ₂ O	315.48	S			78	v.SOL.
Naphthenates							
Nitrate	Ba(NO ₃) ₂	261.35	S			592	SOL.
Nonyl Phenate							
Oxalate	BaC ₂ O ₄	225.36	S			decomp. 400	SL.SOL
Stearate	Ba(C ₁₈ H ₃₅ O ₂) ₂	704.13	S				SL.SOL
Sulphate	BaSO ₄	233.40	S		1580	1149	SL.SOL
Trinitrophloro- glucinate							

BARIUM AND BARIUM COMPOUNDS (2)

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	Inhalation	Irritant
Acute Local -	1	1
Acute Systemic -	3	
Chronic Local -		1
Chronic Systemic -	2	

Additional Information -

- inhaled barium compounds known to cause benign pneumoconiosis called "Baritosis"
- exposure to dusts of sulfide, oxide, and carbonate causes irritation of eyes, nose, throat, skin

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - soluble compounds: 500 $\mu\text{g}/\text{m}^3$
(as Ba)
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany soluble compounds: 500 $\mu\text{g}/\text{m}^3$
(as Ba)

Sweden

D. Additional Information:

BENZENE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	72.5 mm Hg
Chemical Formula -	C ₆ H ₆
Molecular Weight -	78.12
Boiling Point -	80.1 C
Melting Point -	5.5 C
Solubility in Water -	Slightly Soluble

Additional Information -

- Synonyms: Phenyl Hydride, Coal Naphtha
- Clear, colourless to light yellow liquid
- Aromatic odor
- Miscible with alcohol and most organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	2
Acute Systemic -	2	
Chronic Local -	0	
Chronic Systemic -	3	

Additional Information -

- Primarily affects bone marrow resulting in numerous blood changes, and in serious cases, aplastic anemia and death. Some fatal cases diagnosed as leukemia
- Chronic poisoning can occur as a result of daily exposure to unsafe vapor concentrations over long period, or from a single concentrated exposure.
- Chronic exposure can occur through skin absorption.
- Officially recognized as a carcinogen in West Germany and Sweden
- Carcinogenic in some animal experiments

BENZENE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 10000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 10 ppm; 30000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

	(ppm)	($\mu\text{g}/\text{m}^3$)
Sweden (skin)	10	30000

D. Additional information:

- Soviet TLV (1967) 6 ppm
- Czechoslovakia TLV (1969) 16 ppm
- U.S. Occupational Standards:
 - Ceiling Value 25 ppm
 - Peak Value 50 ppm (10 min/8 hour)
- American National Standards Institute TLV (1969) 10 ppm

IV

COMMENTS

- Used as basic raw material for manufacture of many aromatic organic materials in refineries. Also used in manufacture of paints and varnishes, including putty, fillers, stains, and finishes.

BENZIDINE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	
Chemical Formula -	$\text{NH}_2(\text{C}_6\text{H}_4)_2\text{NH}_2$
Molecular Weight -	184.23
Boiling Point -	400 C
Melting Point -	127 C
Solubility in Water -	Slightly Soluble
Additional Information -	
<ul style="list-style-type: none">- Synonyms: Benzidine Base; p-Diaminodiphenyl; 4,4' - Biphenyldiamine- Gray-yellow crystalline powder. Darkens on exposure to light- Soluble in alcohol and ether.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	
Additional Information -		
<ul style="list-style-type: none">- Recognized as a human carcinogen by OSHA (U.S.), Germany, and Sweden- extremely toxic by inhalation, ingestion, and skin absorption; any exposure is considered hazardous- can cause blood and bone marrow damage. Also bladder tumors- on ingestion, causes nausea and vomiting. May be followed by liver and kidney damage.		

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

- Used in the manufacture of various dyes
- used in organic synthesis and as a stiffening agent in rubber compounding
- an analytical agent

BERYLLIUM AND BERYLLIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P.	M.P.	Sol In H ₂ O
Beryllium	Be	9.013	S		2970	1278	INSOL.
Ceramics							
Aluminum Alloys							
Copper Alloys							
Oxide	BeO	25.01	S		3900	2530	INSOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -	3	1
Chronic Systemic -	3	

Additional Information -

- all common Be compounds are extremely toxic by inhalation even in very low concentrations. Beryllium disease is systemic
- Chronic: pneumonitis, lesions of lung, dermatitis, inflammation and enlargement of liver and spleen, cardiac failure, mild edema of brain, inflammation of eye. May be fatal.
- Acute: chemical pneumonitis with systemic effects
- regarded as a human carcinogen in Germany and Sweden
- experimental carcinogen of lungs and bones.

BERYLLIUM AND BERYLLIUM COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: 0.03 ug/m^3
(as Be)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 2 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden 2 ug/m^3

D. Additional Information:

- Soviet TLV (1966) 1 ug/m^3
- American National Standards Institute TLV (1969) 2 ug/m^3
- U.S. Occupational Standard for Beryllium
 - Time Weighted Average 2 ug/m^3
 - Ceiling Value 5 ug/m^3
 - Peak Value 25 ug/m^3 (30 min/8 hours)

IV

COMMENTS

- used as hardening agent in Be-Cu and other alloys
- used as structural material in aerospace industry
- used as moderator in nuclear reactors

CADMIUM AND CADMIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Cadmium	Cd	112.4	S		767	320.9	INSOL
Benzoate	$\text{Cd}(\text{C}_2\text{H}_3\text{O}_2) \cdot 2\text{H}_2\text{O}$	390.66		< 1 mm			SOL.
Chloride	CdCl_2	183.32			960	568	V. SOL
Cyanide	$\text{Cd}(\text{CN})_2$	164.44	S				SOL.
2-Ethylhexoate							
Nitrate	$\text{Cd}(\text{NO}_3)_2$	236.41	S		350		V. SOL.
Oxide	CdO	128.40				DECOMP. 900	INSOL.
Selenide	CdSe	191.36	S			> 1350	INSOL.
Stearate							
Sulphate	CdSO_4	208.46	S			1000	V. SOL
Sulphides	CdS	144.46			Subl. 980	1750*	SL. SOL.
Sulphoselenides							

* 100 atm. pressure

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -	3	
Chronic Systemic -	3	

Additional Information -

- inhalation of Cd compounds, specifically metal fumes, oxide, and salts, causes pulmonary emphysema and bronchitis. Also damage to kidneys where accumulation of Cd takes place.
- in severe exposure, lung damage is fatal
- other effects are gastric and intestinal disorders and damage, liver damage and anemia
- implicated in cardiovascular disorders and hypertension
- Cd compounds are suspected carcinogens of connective tissue, lungs and liver. Cadmium is carcinogenic in some animal experiments.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: (as Cd)
5.0 ug/m³

Average Concentration over 24 hours - 2.0 ug/m³

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Cd dusts and salts: 50 ug/m³ (as Cd)
Cd oxide fume: 50 ug/m³ (as Cd)
(ceiling)
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere: (ug/m³)

West Germany Cd oxide fume: 100 (as Cd)
(ceiling)

Sweden Cd dusts and salts: 20 (as Cd)

D. Additional Information:

- U.S. TLV of 50 ug/m³ adopted to prevent acute or chronic toxic effects of Cadmium fume inhalation
- Soviet (1967) and Czechoslovakia (1969) TLV 100 ug/m³
- U.S. Occupational Standards
- Time Weighted Average: 200 ug/m³ Ceiling Value: 600 ug/m³

CARBON BLACK

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	
Chemical Formula -	C
Molecular Weight -	12.01
Boiling Point -	
Melting Point -	
Solubility in Water -	Insoluble
Additional Information -	
- Amorphous powder	
- Sublimes at 3652 C	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	
Acute Systemic -	0	
Chronic Local -	3	3
Chronic Systemic -		
Additional Information -		
- has caused cancer in the nasal sinuses, lungs and skin, when oily material present (coal tar, etc.) Carcinogenic property may be due to some coal tar product which adheres to the soot (carbon black) rather than the soot itself.		

CARBON BLACK (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 25 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 3500 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional information:

IV

COMMENTS

Rubber (tires), printing inks, paints, plastics and synthetic resins, textiles

CARBON DISULPHIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	336 mm Hg
Chemical Formula -	CS ₂
Molecular Weight -	76.1
Boiling Point -	46.5 C
Melting Point -	-110.8 C
Solubility in Water -	Soluble
Additional Information -	
- clear, colorless liquid. Almost odorless when pure	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- Toxic by inhalation, ingestion, and skin absorption
- Chief effect on central nervous system, acting as a narcotic and anesthetic
- death from respiratory failure in acute poisoning

CARBON DISULPHIDE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 330 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 20 ppm; 60000 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>(ug/m^3)</u>
West Germany		
Sweden (skin)	10	30000

D. Additional Information:

- U.S. Occupational Standard: Ceiling Value 30 ppm
- Soviet TLV (1967) 4 ppm
- Czechoslovakia TLV (1969) 10 ppm
- American National Standards Institute TLV (1968) 20 ppm
- U.S. Occupational Standard:
Peak Value: 100 ppm (30 min/8 hours)

IV

COMMENTS

- Used in manufacture of plastics and synthetic resins.

CARBON TETRACHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	114.5 mm Hg
Chemical Formula -	C Cl ₄
Molecular Weight -	153.8
Boiling Point -	76.8 C
Melting Point -	-22.6 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonym: Tetrachloromethane	
- Colorless liquid. Characteristic, non-irritating odor. Odor threshold 10 ppm	
- Miscible with alcohol, many common organic solvents, and most of fixed and volatile oils	
- decomposes to phosgene at high temperatures.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	0	
Acute Systemic -	3	
Chronic Local -		1
Chronic Systemic -	3	

Additional Information -

- Irritant to mucous membranes. Depresses central nervous system
- Exposures to high concentrations may result in death from respiratory failure.
- Long term exposure to low concentrations (also after-effects of severe non-fatal exposures) results in damage to kidneys, liver and lungs.
- vapour is irritating to eyes
- contact with liquid causes dermatitis
- a suspected carcinogen. Found to be carcinogenic in some animal experiments

CARBON TETRACHLORIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 20000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 10 ppm; 65000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	10	65000
Sweden(skin)	10	65000

D. Additional Information:

- Soviet TLV (1966) 3 ppm
- Czechoslovakia TLV (1969) 8 ppm
- American National Standards Institute TLV (1957) 10 ppm
- U.S. Occupational Standards

Ceiling Value 25 ppm
Peak Value 200 ppm 200 ppm (5 min/8 hour)

IV

COMMENTS

- Used in production of refrigerants and propellants (chlorofluorohydrocarbons)
- metal degreasing, agricultural fumigant, chlorinating organic compounds.

CHLORINE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	7.86 atms.
Chemical Formula -	Cl ₂
Molecular Weight -	70.9
Boiling Point -	-34.5 C
Melting Point -	-101 C
Solubility in Water -	Soluble
Additional Information -	
- Greenish-yellow gas. Pungent, irritating, suffocating odor. Odor threshold less than 1 ppm	
- Vapor density 3.214 gm/litre (at 0C and 1 atms)	
- Extremely reactive. Strong oxidizing and bleaching properties	
- In presence of moisture, chlorine forms hypochlorite which is a strong oxidant. Wet chlorine is extremely corrosive to the common metals.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	0	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- At low concentrations (1 ppm), main effect is irritation of eyes, nose, throat, and respiratory tract.
- Inhalation of large doses can damage lung tissue, and produce pulmonary edema, pneumonitis, emphysema, or bronchitis.
- In extreme cases, death may occur by suffocation.

CHLORINE

(2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:Point of Impingement (half-hour average) - 300 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:Threshold Limit Value - 1 ppm; 3000 ug/m³
(Over 8 Hours) -C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany	0.6	1500
Sweden	1	3000

D. Additional Information:

- TLV of 1 ppm is adopted to minimize chronic changes in lungs
- Soviet TLV (1966) 0.3 ppm
- Czechoslovakia TLV (1969) 1 ppm

IV

COMMENTS

- Used in production of organic and inorganic chemicals
- Used to bleach pulp for paper and rayon manufacture
- Used in treatment of water and wastewater
- Used in production of pesticides, herbicides, refrigerants, plastics, propellants, soap and cleaning compounds, pigments, industrial gases, textiles.
- Used in chlor-alkali processes and petroleum refining.

CHLORINE DIOXIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	831 mm Hg @ 11 C
Chemical Formula -	Cl O ₂
Molecular Weight -	67.45
Boiling Point -	9.9 C
Melting Point -	-59.5 C
Solubility in Water -	Soluble
Additional Information -	
- Red yellow gas	
- very reactive and strong oxidizing agent	
- dissolves in alkalis forming a mixture of chlorite and chlorate	
- decomposes when heated, emitting toxic fumes of chlorine	
- reacts with water or steam to form fumes of hydrochloric acid	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -		
Chronic Local -		3
Chronic Systemic -		

Additional Information -

- severe irritant to eyes and respiratory tract
- may cause pulmonary edema
- can be fatal at high concentrations (20 ppm)
- can cause bronchitis and emphysema following prolonged exposure to low concentrations.

CHLORINE DIOXIDE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 85 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 0.1 ppm; 300 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	0.1	300
Sweden	0.1	300

D. Additional Information:

- TLV OF 0.1 ppm is adopted to prevent irritation and possible bronchitis.

IV

COMMENTS

- Used in water and waste water treatment
- Used as a bleaching agent for wood, pulp, fats, oils and flour
- Used in manufacture of sulfur and sulfuric acid

CHLOROBENZENE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	11.7 mm Hg
Chemical Formula -	C_6H_5Cl
Molecular Weight -	112.6
Boiling Point -	131.7 C
Melting Point -	-45 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonym: Monochlorobenzene, Chlorobenzol, Phenyl Chloride	
- Clear, colorless volatile liquid	
- Almond-like odor	
- Miscible with most organic solvents	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -	2	
Chronic Local -	0	
Chronic Systemic -	2	

Additional Information -

- Strong narcotic. Possesses only slight irritant qualities.
- Generally not as toxic as phenol
- Animal studies reveal lung, liver and kidney damage following repeated exposures at high concentrations.

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

75 ppm; 350000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

50

230000

Sweden

D. Additional Information:

- TLV (U.S.) of 75 ppm adopted to prevent narcotic effects or chronic poisoning
- Soviet TLV (1966) 10 ppm
- Czechslovakia TLV (1969) 43 ppm

IV

COMMENTS

- Used in petroleum refining, paint and varnish manufacture
- Used in production of pesticides
- Used in production of various organic solvents

CHLOROFORM

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	172 mm Hg
Chemical Formula -	CHCl_3
Molecular Weight -	119.4
Boiling Point -	61.3 C
Melting Point -	- 63.5 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Synonym: Trichloromethane	
- Clear, colorless, volatile liquid	
- Heavy ethereal odor; sweet taste	
- Miscible with alcohol, organic solvents, and fixed and volatile oils	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- Main effect is depression of the central nervous system (more potent than CCl_4)		
- Prolonged inhalation will cause death from cardiac and respiratory failure		
- Its wide use as an anesthetic has been abandoned due to its damaging effects on the liver, heart and kidney		
- Causes irritation of the eyes and mucous membranes of the respiratory tract.		
- A suspected carcinogen. Found to be carcinogenic in some animal experiments.		

CHLOROFORM (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 25 ppm; 120000 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany	50	240000
Sweden	25	125000

D. Additional Information:

- TLV (U.S.) of 25 ppm is adopted to prevent any serious short-term effects on the liver
- Czechoslovakia TLV (1969) 10 ppm
- American National Standards Institute TLV (1957) 10 ppm

IV

COMMENTS

- Used in manufacture of fluorocarbon refrigerants and propellants, fluorocarbon plastics, dyes, and pigments, insecticides, pharmaceuticals
- Used in petroleum refining

bis - CHLOROMETHYL ETHER

I PROPERTIES

Physical State (ambient temp.) - L
Vapour Pressure (25°C) -
Chemical Formula - $O(CH_2Cl)_2$
Molecular Weight - 115
Boiling Point - 105
Melting Point -
Solubility in Water - INSOLUBLE

Additional Information -

- Synonyms: Dichlorinated methyl oxide; BCME, sym- dichloromethyl ether; Dimethyl -1,1 - Dichloroether
- Colorless, volatile liquid; suffocating odour
- Soluble in acetone, benzene, ethyl and methyl alcohol
- Highly reactive liquid with high vapor pressure

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		

Additional Information -

- Strong irritant to eyes and respiratory tract
- regarded as a carcinogen by OSHA (U.S) and Sweden

bis - CHLOROMETHYL ETHER (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 0.001 ppm

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

- Used as intermediate in manufacture of resins
- bis-Chloromethyl Ether may form in air as a product of the reaction between Formaldehyde and Hydrogen Chloride

CHLOROPRENE

I PROPERTIES

Physical State (ambient temp.) - L

Vapour Pressure (25°C) -

Chemical Formula - $\text{CH}_2\text{CHCClCH}_2$

Molecular Weight - 88.5

Boiling Point - 60 C

Melting Point -

Solubility in Water - Slightly Soluble

Additional Information -

- Synonyms: 2- chloro, 1,3 - butadiene, Chlorobutadiene
- colorless
- soluble in alcohol

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	2
Acute Systemic -	3	3
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- highly toxic by ingestion, inhalation, and skin absorption
- nervous system depressant
- dermatitis, eye injury and anemia have been reported in humans

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 25 ppm; 90000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany	25	90000
Sweden	25	90000

D. Additional Information:

- subject of current OSHA carcinogenesis inquiry

COMMENTS

- used in manufacture of neoprene

CHROMIUM AND CHROMIUM COMPOUNDS
I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Chromium	Cr	60.0	S		2200	1900	INSOL.
Chrome pigments (Chromates)	PbCrO ₄ (red) Pb CrO ₄ .PbO (yellow)	323.18 546.37	S S			844	INSOL. INSOL.
-ic Acid (oxide)	CrO ₃	100.01	S			196	V. SOL.
Chromite	(FeO,Cr ₂ O ₃)						
(II) Acetate	Cr(C ₂ H ₃ O ₂) ₂	170.09	S				SL.SOL.
(III) Acetate	Cr(C ₂ H ₃ O ₂) ₃ .H ₂ O	247.15	S				SOLUBLE
Lignosulphonates							
(II) Sulphate	CrSO ₄ .7H ₂ O	274.17	S				SOL.
(III) Sulphate	Cr ₂ (SO ₄) ₃	392.18	S			100	SOL
(III) Sulphate	Cr ₂ (SO ₄) ₃ . 15H ₂ O	662.41	S				SOL.
(III) Sulphate	Cr(SO ₄) ₃ . 18H ₂ O	716.45	S				V. SOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -		
Chronic Local -	3	3
Chronic Systemic -	3	

Additional Information -

- Hexavalent compounds more toxic than trivalent. Metal is non-toxic
- irritative and corrosive to body tissue
- inhalation causes perforation of nasal septum and respiratory disorders: chronic inflammation of lungs, pneumonia, laryngeal congestion, emphysema, tracheitis, chronic bronchitis, pharyngitis
- causes hypersensitivity with contact dermatitis. Causes skin ulceration
- Chromate salts are recognized carcinogens (U.S., Germany, Sweden) of lungs, nasal cavity, and paranasal sinus. Also experimental carcinogens of stomach and larynx.

CHROMIUM AND CHROMIUM COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: (as Cr)
30 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines: $\mu\text{g}/\text{m}^3$

Threshold Limit Value - Chromic acid, chromates: 100 (as CrO_3)
Sol. chromic, chromous salts: 500 (as Cr)

(Over 8 Hours) - Insol. chromates - Pb, Zn, and
chromate-chromite ore: 100 (as Cr)
CARCINOGEN

C. Occupational Standards (TLV) Elsewhere:

West Germany Chromic acid and chromates: 100 $\mu\text{g}/\text{m}^3$

Sweden Chromic Acid and chromates: 50 $\mu\text{g}/\text{m}^3$

D. Additional Information:

For Chromic Acid and Chromates:

- Soviet TLV (1966) 10 $\mu\text{g}/\text{m}^3$
- Czechoslovakia TLV 100 $\mu\text{g}/\text{m}^3$
- American National Standards Institute TLV 100 $\mu\text{g}/\text{m}^3$

IV

COMMENTS

COAL TAR PITCH

I

PROPERTIES

Physical State (ambient temp.) -

Vapour Pressure (25°C) -

Chemical Formula -

Polynuclear aromatic compounds

Molecular Weight -

Boiling Point -

Melting Point -

Solubility in Water -

Additional Information -

- black-brown tar-like mass

II

HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- highly toxic by inhalation		
- recognized as a human carcinogen by the American Conference of Governmental Industrial Hygienists (U.S.)		

COAL TAR PITCH (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 200 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

COMMENTS

- binder for carbon electrodes
- base for paints and coatings
- paving and roofing
- sealants
- tar bonded refractory bricks
- plasticizer for elastomers and polymers

COBALT AND COBALT COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Cobalt	Co	58.9	S		3100	1943	insol.
Acetate	Co(C ₂ H ₃ O ₂) ₃	236.07	S			dec.100	insol.
Blue	CoAl ₂ O ₄	176.89	S				insol.
Ethylhexoate							
Decanoates							
Linoleate	Co(C ₁₈ H ₃₁ O ₂) ₂	617.83	S				insol.
Naphthenates	indefinite	indefi- nite	S				
Soaps							
Tallate	Salt of tall oil mixture of rosin acids and fatty acids						
Tetracarbonyl	Co ₂ (CO) ₈	342.0		1mm	decgmn. 51°C 52°C		

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	1	
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- inhalation may cause pulmonary symptoms		
- powder may cause dermatitis		
- a suspected carcinogen of connective tissue and lungs		
- a recognised experimental (animal) carcinogen in Germany		
- a recognised human carcinogen in Sweden		

COBALT AND COBALT COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - metal dust: 10 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany metal dust: 500 $\mu\text{g}/\text{m}^3$

Sweden metal dust: 100 $\mu\text{g}/\text{m}^3$

D. Additional Information:

IV

COMMENTS

- about 75-80% used for metallurgical applications
- remainder taken up by chemical applications

COPPER AND COPPER COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Copper	Cu	63.5	S		2595	1083	INSOL.
2-Ethylhexoate							
Naphthenate	(C ₆ H ₅ COO) ₂ Cu	221.9					INSOL.
Oleate	Cu(C ₁₈ H ₃₃ O ₂) ₂	626.47	S				INSOL.
(I) Oxide	Cu ₂ O	143.08	S		1800	1235	INSOL.
(II) Oxide	CuO	79.54	S			1326	INSOL.
β - Quinolinolate							
(I) Sulphate	Cu ₂ SO ₄	223.14				200	Dissociation
(II) Sulphate	CuSO ₄	159.60					SOL.
Tallate	Salt of tall oil mixture of rosin acids and fatty acids.						
<u>Cupric</u>							
Acetate	Cu(C ₂ H ₃ O ₂) ₂ ·H ₂ O	199.64	S		240	115	SOL.
Chloride	CuCl ₂	134.48	S			498	SOL.
Citrate	2Cu ₂ C ₆ H ₄ O ₇	315.18	S				SL.SOL
Dichromate	CuCr ₂ O ₇ ·2H ₂ O	315.59	S				SOL.
Nitrate	Cu(NO ₃) ₂	187.56	S		Subl. 150- 255	255	SOL.
Salicylate	Cu(C ₇ H ₅ O ₃) ₂ ·4H ₂ O	409.8	S				SOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	Inhalation	Irritant
Acute Local -	1	1
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -	1	

Additional Information -

- copper oxide (fume, dust) causes irritation of eyes and upper respiratory tract, nausea, metal fume fever
- dusts of copper salts cause perforation of nasal septum, skin irritation, and inflammation of eyes.

COPPER AND COPPER COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: 100 ug/m^3
(as Cu)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Copper Fume: 200 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany	Copper dust: 1000 ug/m^3
	Copper Fume: 100 ug/m^3
Sweden	

D. Additional Information:

IV COMMENTS

CREOSOTE

I PROPERTIES

Physical State (ambient temp.) - L
Vapour Pressure (25°C) -
Chemical Formula - Mixture of phenols
Molecular Weight -
Boiling Point - 203-220 C
Melting Point -
Solubility in Water -
Additional Information -

- Synonyms: wood creosote, beachwood
- consists of phenanthrene, acenaphthene, fluorene, diphenylene oxide, anthracene, and carbazole
- clear - yellow oily liquid
- smoky odour

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	2
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- caustic substance
- large doses may cause damage to the intestinal and cardiovascular systems

CREOSOTE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- wood preservative
- obtained from the distillation of wood tar

CRESOLS

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	1.06 mm Hg @ 38.2 C
Chemical Formula -	$C_6H_4OHCH_3$
Molecular Weight -	108.1
Boiling Point -	191-203 C
Melting Point -	10.9 - 35.5 C
Solubility in Water -	Slightly Soluble

Additional Information -

- Synonyms: Cresylic Acid, Cresylol, Tricresol Methyl Phenol
- Mixture of isomeric cresols (m,o,p forms) obtained from coal tar. Belongs to Phenol group of aromatic organic compounds
- Colorless, or yellow-brown, or pink liquid
- Phenol-like odor
- Soluble in alcohol

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	2
Acute Systemic -	2	
Chronic Local -		3
Chronic Systemic -	2	

Additional Information -

- effect similar to phenol, except less severe. A general protoplasmic poison
- corrosive action on skin and mucous membranes; causes dermatitis. Absorbed through skin.
- possibly damaging to kidneys, liver, and nervous system

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 230 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 5 ppm; 22000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) - (all isomers)

C. Occupational Standards (TLV) Elsewhere:

	<u>ppm</u>	<u>$\mu\text{g}/\text{m}^3$</u>
West Germany (skin)	5	22000

Sweden

D. Additional Information:

- U.S. TLV of 5 ppm adopted to prevent irritation effects

COMMENTS

- manufacturing of synthetic resins, herbicides, various chemicals
- used as a disinfectant, and in textile and leather industry

CUMENE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	4.5 mm Hg
Chemical Formula -	$C_6H_5CH(CH_3)_2$
Molecular Weight -	120.2
Boiling Point -	152 C
Melting Point -	- 96 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonyms: Isopropylbenzene, cumol, 2- phenylpropane	
- colourless liquid	
- soluble in alcohol	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	2	
Additional Information -		
- depressant of the central nervous system		
- highly toxic through skin absorption		
- more toxic than benzene or toluene		

III CUMENE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 50 ppm; 245000 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany (skin)	50	245000

Sweden

D. Additional Information:

IV COMMENTS

- found in American petroleum
- used in production of phenol, acetone, and alpha-methylstyrene
- used as a solvent

CYANOGEN

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	
Chemical Formula -	C_2N_2
Molecular Weight -	52.04
Boiling Point -	-21.0 C
Melting Point -	-34.4 C
Solubility in Water -	Soluble

Additional Information -

- Synonyms: Ethanedinitrile; Dicyan; Oxalonitrile; Oxalic Nitrile; Prussite
- Colorless gas; pungent, penetrating odor
- Soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- Comparable to Hydrogen Cyanide in its toxic effects		
- causes eye and nasal irritation		

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 10 ppm
(Over 8 Hours) -

C. <u>Occupational Standards (TLV) Elsewhere:</u>	(ppm)	(ug/m ³)
West Germany	10	22000

Sweden

D. Additional Information:

- U.S. TLV of 10 ppm is adopted by analogy with hydrogen cyanide, and to prevent irritation as well as systemic effects

IV COMMENTS

- used primarily in organic synthesis
- used as a fuel gas for welding and cutting heat-resistant metals
- used as rocket and missile propellant
- used as a fumigant

DIBUTYL PHTHALATE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	1.03 mm Hg at 148.2 C
Chemical Formula -	$C_6H_4 (COOC_4H_9)_2$
Molecular Weight -	278.3
Boiling Point -	340 C
Melting Point -	- 35 C
Solubility in Water -	Insoluble
Additional Information -	
- Colorless, odorless, stable, oily liquid	
- Miscible with common organic solvents	
- Normal, meta, and ortho forms	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- Effect similar to that of Phthallic Anhydride		
- May cause eye inflammation, chronic bronchitis and emphysema		

DIBUTYL PHTHALATE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

5,000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- TLV (U.S.) of 5000 $\mu\text{g}/\text{m}^3$ is adopted more from the standpoint of controlling excessive airborne mists of Dibutyl Phthalate rather than as a health measure.

IV

COMMENTS

- Plastics and synthetic resins, paint and varnish, explosives, photographic materials, insecticide.

P-DICHLOROBENZENE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1.08 mm Hg at 30 C
Chemical Formula -	C ₆ H ₄ Cl ₂
Molecular Weight -	147.0
Boiling Point -	173.4
Melting Point -	53 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonym: 1,4 - Dichlorobenzene	
- White crystals; sublimes easily	
- Penetrating odor	
- Soluble in benzene, alcohol, and ether	
- Also in meta and ortho forms	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -		
Chronic Local -		2
Chronic Systemic -	1	

Additional Information -

- The P-isomer is less toxic than the O-form
- Irritating to skin, eyes, and throat
- Animal studies reveal liver and kidney damage
- Has been reported to cause liver injury in humans

P-DICHLOROBENZENE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

75 ppm; 450000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany	75	450000
Sweden		

D. Additional Information:

IV

COMMENTS

- Used as an insecticide, fumigant, and in the manufacture of dyes and pharmaceuticals.

3,3' DICHLOROBENZIDINE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	
Chemical Formula -	$C_6H_3ClNH_2C_6H_3ClNH_2$
Molecular Weight -	253.1
Boiling Point -	
Melting Point -	133 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonym: 3,3' - dichloro - 4,4' - diamino biphenyl	
- crystalline solid; purple-to-gray	
-soluble in alcohol, ether, benzene, and glacial acetic acid	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- recognized as a carcinogen by OSHA (U.S.), Germany and Sweden		
- No exposure by any route should be permitted		

III 3,3'-DICHLOROBENZIDINE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV COMMENTS

- Used as an intermediate for dyes and pigments
- used as a curing agent for isocyanate-terminated and urethane resins

DIMETHYLAMINOAZOBENZENE

I PROPERTIES

Physical State (ambient temp.) - S

Vapour Pressure (25°C) -

Chemical Formula - $C_6H_5N=NC_6H_4N(CH_3)_2$

Molecular Weight - 229.1

Boiling Point -

Melting Point - 116

Solubility in Water - Insoluble

Additional Information -

- synonym: Methyl Yellow
- Yellow crystalline solid
- Soluble in alcohol, ether, mineral acids, oils

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- Ingestion causes liver cancer in experimental animals
- recognized as a carcinogen by OSHA (U.S.)
- no exposure by any route should be permitted
- Carcinogenic in several animal experiments. Causes liver cancer on an acute basis in rats and mice.

III DIMETHYLAMINOAZOBENZENE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- US Occupational Standard: Carcinogen

IV COMMENTS

- used as an indicator in volumetric analysis

DIMETHYL SULPHATE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	
Chemical Formula -	$(CH_3)_2 SO_4$
Molecular Weight -	126.1
Boiling Point -	188 C
Melting Point -	-31.8 C
Solubility in Water -	Soluble
Additional Information -	
<ul style="list-style-type: none"> - Synonym: methyl sulphate - colourless, odourless liquid - soluble in alcohol, ether, aromatic hydrocarbons - odourless 	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -	3	3
Chronic Systemic -	3	

Additional Information -

- Recognized carcinogen by Germany, Sweden, and the American Conference of Governmental Industrial Hygienists (U.S.)
- extremely toxic through skin absorption
- 6-8 hour exposure may cause fatal kidney, liver, or lung damage
- short mild exposure may result in inflammation of the mucous membranes of the respiratory system

III DIMETHYL SULPHATE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	.01	50

Sweden

D. Additional Information:

IV

COMMENTS

- Used as methylating agent for amines and phenols

ETHANOLAMINE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	0.36 mm at 20 C
Chemical Formula -	$\text{NH}_2\text{CH}_2\text{CH}_2\text{OH}$
Molecular Weight -	61.1
Boiling Point -	170.5 C
Melting Point -	10.5 C
Solubility in Water -	Very Soluble

Additional Information -

- Synonym: Monoethanol Amine, 2-Aminoethanol
- Related compounds: Di-, and Tri-Ethanolamine
- Colorless, viscous liquid; Ammoniacal odor
- Soluble in organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- Irritant and necrotic effect on skin
- Inhalation animal studies reveal it to be a central nervous system stimulant at low doses, and a central nervous system depressant at lethal doses.

ETHANOLAMINE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

3 ppm; 6000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- Soap and cleaning compounds
- Used in scrubbing acid gases especially in synthesis of ammonia
- Manufacture of emulsion paints, polishes, and pharmaceuticals
- Used as a rubber accelerator

I ETHYL BENZENE
 PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	9.76 mm Hg
Chemical Formula -	$C_6H_5C_2H_5$
Molecular Weight -	106.2
Boiling Point -	136.2 C
Melting Point -	- 95 C
Solubility in Water -	Insoluble
Additional Information -	
- Synonym: phenylethane	
- colorless liquid	
- aromatic odour	
- soluble in alcohol, benzene and ether	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- highly irritating, especially to the eyes		
- moderately toxic by skin absorption		
- inflammation may result upon contact with skin		

ETHYL BENZENE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

ETHYL BENZENE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design
Standard: 4000 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 435000 ug/m³

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:
(ppm) (ug/m³)

West Germany	100	435000
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Sweden

D. Additional Information:

IV COMMENTS

- Used as an intermediate in production of styrene
- Used as a solvent

ETHYL CHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	1079 mm Hg
Chemical Formula -	CH ₃ CH ₂ Cl
Molecular Weight -	64.5
Boiling Point -	12.3 C
Melting Point -	-136.4 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Synonym: Chloroethane, Muriatic Ether, Hydrochloric Ether	
- Colorless gas; ether-like odor; burning taste	
- Miscible with most commonly-used solvents	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	1
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- Least toxic of all chlorinated hydrocarbons
- Irritant to eyes
- A central nervous system depressant, but effects are usually transient

ETHYL CHLORIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 1000 ppm; 2,600,000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	1000	2,600,000

Sweden

D. Additional Information:

- TLV (U.S) of 1000 ppm adopted to prevent signs of narcotic effects.

IV

COMMENTS

- Used in manufacture of tetraethyl lead and ethylcellulose
- Used as an anesthetic and alkylating agent
- Production of insecticides
- Solvent for fats, oils, waxes, and resins

ETHYLENE DIBROMIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	14.7 mm Hg
Chemical Formula -	CH ₂ BrCH ₂ Br
Molecular Weight -	187.9
Boiling Point -	131.4 C
Melting Point -	9.3 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Synonym: 1,2 - Dibromoethane	
- Colourless heavy liquid; sweet odour	
- Miscible with most solvents	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	2	
Additional Information -		
- Toxic effects resemble those of ethylene dichloride		
- Strong irritant to eyes and skin		
- In high doses, causes damage to liver and kidneys. Can be fatal		
- Inhalation also causes pulmonary lesions		
- A central nervous system depressant, but less severe than ethylene dichloride.		

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 20 ppm; 145000 ug/m³

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany (skin)	25	190000

Sweden

D. Additional Information:

- U.S. Occupational Standards:

Time Weighted Average	20 ppm
Ceiling Value:	30 ppm
Peak Value:	50 ppm (5 min/8 hours)

IV COMMENTS

-Pesticides; refining and blending of oils, greases and petroleum;
pharmaceuticals, medicine.

ETHYLENE DICHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	75.7 mm Hg
Chemical Formula -	CH ₂ ClCH ₂ Cl
Molecular Weight -	99.0
Boiling Point -	83.5 C
Melting Point -	-35.7 C
Solubility in Water -	Soluble
Additional Information -	

- Synonym: 1,2 - dichloroethane, EDC
- colourless liquid
- pleasant odour, sweet taste
- miscible with alcohol, chloroform, ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	3	

Additional Information -

- toxic through ingestion and skin absorption
- vapor may cause damage to the eyes
- vapor irritates respiratory system
- produces narcotic effect
- ingestion may cause liver and kidney injury and death

III

ETHYLENE DICHLORIDE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 50 ppm; 200000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TIV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	20	80,000
Sweden	20	80,000

D. Additional Information:

- U.S. Occupational Standards:

Time Weighted Average: 50 ppm

Ceiling Value: 100 ppm

Peak Value 200 ppm (5 min/3 hours)

IV

COMMENTS

- solvent for fats, oils, waxes, gums resins and rubber
- manufacture of acetyl cellulose
- used in manufacture of vinyl chloride

ETHYLENE OXIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	1095 mm Hg @ 20 C
Chemical Formula -	(CH ₂) ₂ O
Molecular Weight -	44.1
Boiling Point -	10.7 C
Melting Point -	- 111.3 C
Solubility in Water -	Soluble
Additional Information -	
- Synonym: 1,2 - Epoxyethane , Dimethylene Oxide	
- Colorless Gas	
- Soluble in organic solvents	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -		
Additional Information -		
- irritates the eye and nose		
Exposure to low concentrations of vapour above threshold limit may cause nausea and vomiting. Continuous exposure results in numbing of sense of smell. High concentrations can produce pulmonary edema and mucous membrane irritation.		

ETHYLENE OXIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 28500 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 50 ppm; 90000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	50	90000
Sweden	20	36000

D. Additional Information:

- Soviet TLV (1966) 0.5 ppm

IV

COMMENTS

- Plastics and resins, soaps and cleaning compounds
- intermediate for ethyleneglycol production (antifreeze)
- raw material in acrylonitrile production
- used throughout organic chemical industry

ETHYLENIMINE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	160 mm Hg @ 20 C
Chemical Formula -	NHCH_2CH_2
Molecular Weight -	43.1
Boiling Point -	56 C
Melting Point -	-71.5 C
Solubility in Water -	
Additional Information -	

- Synonyms: ethylene imine; dimethylenimine; Aziridine; Azacyclopropane; Azirane; Dimethylaminoethylene
- clear, colourless oil; pungent, ammonia-like odour
- miscible with most organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- highly toxic and corrosive. Absorbed by skin
- can cause allergic sensitization of skin. Can also cause severe eye injury
- recognized as a carcinogen by OSHA (U.S.), Germany, and Sweden

III ETHYLENIMINE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 0.5 ppm; 1000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	0.5	1000

Sweden

D. Additional Information:

- Soviet TLV (1966) 0.01 ppm
- U.S. Occupational Standard: Carcinogen

IV COMMENTS

- used as an intermediate and monomer for fuel oil and lubricant refining
- used in manufacturing of pharmaceuticals, adhesives, polymer stabilizers

FORMALDEHYDE

I

PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	767 mm Hg at -19.5 C
Chemical Formula -	HCHO
Molecular Weight -	30.0
Boiling Point -	-21 C
Melting Point -	-92 C
Solubility in Water -	Soluble

Additional Information -

- Synonym: Methanal, Methyl Aldehyde
- Colorless gas with strong pungent odor
- Readily polymerizes at normal temperature and so is not available as a gaseous monomer. Available commercially as a 37-50% aqueous solution with 15% methanol to inhibit polymerization (Formalin).

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- irritates mucous membranes of eyes, nose, throat, respiratory tract
- solutions have hardening or tanning action on the skin; may cause dermatitis

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 65 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - $12 \text{ ppm}; 3000 \text{ ug/m}^3$
(Over 8 Hours) - (ceiling)

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m^3)
West Germany	1	1200 (ceiling)
Sweden	2	3000 (ceiling)

D. Additional information:

- TLV (U.S.) of 2 ppm adopted to prevent respiratory injury
- Soviet TLV (1966) 0.8 ppm
- Czechoslovakia (1969) 1.6 ppm
- American National Standards Institute TLV (1967) 3 ppm
- U.S. Occupational Standard 3 ppm (time weighted average)
 - Ceiling Value 5 ppm
 - Peak Value 10 ppm 10 ppm (30 min/8 hours)

IV

COMMENTS

- Pulp and paper, paint and varnish, sulphur and sulphuric acid, textiles and leather, pharmaceuticals and medicine.
- Used as a fertilizer and fungicide.

FORMIC ACID

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	33.3 mm Hg
Chemical Formula -	HC ₂ OOH
Molecular Weight -	46.0
Boiling Point -	100.8 C
Melting Point -	8.2 C
Solubility in Water -	Very Soluble

Additional Information -

- Synonym: Methanoic Acid, Hydrogen Carboxylic Acid
- Colorless, fuming liquid
- Pungent, penetrating odor
- Soluble in alcohol and ether.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -		

Additional Information -

- dangerously caustic to the skin.
- produces blisters almost instantly.
- fumes extremely irritating to mucous membranes

FORMIC ACID

(2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design
Standard: 1500 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 5 ppm; 9000 ug/m³

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany	5	9000

Sweden

D. Additional information:

- TLV (U.S.) of 5 ppm adopted to prevent irritation of eyes, skin, and respiratory passages.

IV

COMMENTS

- Used in dying and finishing of textiles and paper. Also leather treatment.
- Manufacture of fumigants, insecticides, lacquers, and refrigerants.

HYDROGEN CHLORIDE

I PROPERTIES

Physical State (ambient temp.) - G
Vapour Pressure (25°C) -
Chemical Formula - HCl
Molecular Weight - 36.46
Boiling Point - -84.9
Melting Point - - 114.8 C
Solubility in Water - Soluble

Additional Information -

- Colorless gas; suffocating odor
- Soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -		

Additional Information -

- severe exposures may cause pulmonary edema
- exerts destructive action on mucous membranes and skin
- Exposure to gas results in chemical burns or dermatitis.

HYDROGEN CHLORIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (ceiling) 5 ppm; 7000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	5	7000 (ceiling)
Sweden	5	7000 (ceiling)

D. Additional Information:

- TLV (U.S.) of 5 ppm adopted to prevent severe irritation
- Soviet TLV (1966) 4 ppm
- Czechoslovakia (1969) 5 ppm
- U.S. Occupational Standard: Ceiling Value 5 ppm

IV

COMMENTS

- Plastics, synthetic resins, organic chemical industry in general.
Source incineration of chlorinated hydrocarbons, including vinyl chloride monomer
- Used in food industry: 1) in manufacture of monosodium glutamate, 2) as hydrolyzing agent in manufacture of dextrose and syrups from starch.
- Metal industry: used in removal of scale and oxides (pickling), reclamation of iron from low-grade ores and as an etching medium.
- Rubber reclamation

HYDROGEN CYANIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	613 mm Hg
Chemical Formula -	HCN
Molecular Weight -	27.04
Boiling Point -	25.7 C
Melting Point -	- 13.24 C
Solubility in Water -	Very Soluble
Additional Information -	
- Colorless gas. Faint characteristic odor of bitter almonds	
- Dissolves in water to form hydrocyanic acid (Prussic Acid)	
- Soluble in alcohol and ether	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- A protoplasmic poison		
- causes death through asphyxiation. Combines with enzymes associated with cellular oxidation; prevents oxygen uptake, Suspension of tissue oxidation lasts only while cyanide is present; normal function restored upon its removal		
- may cause systemic damage by absorption through the skin		

HYDROGEN CYANIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 1150 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 10 ppm; 11000 ug/m^3

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m^3)
West Germany (skin)	10	11000

Sweden (skin)	10	11000
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D. Additional Information:

- Soviet TLV (1966) 0.3 ppm
- Czechoslovakia TLV (1969) 2.7 ppm

IV

COMMENTS

- Used in preparation of numerous chemical products and intermediates
- Used as a disinfectant.

HYDROGEN FLUORIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	906 mm Hg
Chemical Formula -	HF
Molecular Weight -	20.0
Boiling Point -	19.4 C
Melting Point -	-92.3 C
Solubility in Water -	Very Soluble
Additional Information -	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	3	

Additional Information -

- highly irritating and corrosive to skin, eyes, mucous membranes and lungs
- inhalation may cause ulcers of upper respiratory tract
- hydrofluoric acid produces severe skin burns. Affects subcutaneous tissues and may lead to gangrene.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

<u>A. Ontario Environmental Air Standards:</u>		Total Fluorides (expressed as HF)
Point of Impingement (half-hour average) -		(APR-OCT) 8.6 $\mu\text{g}/\text{m}^3$ (OCT-APR) 17.2 $\mu\text{g}/\text{m}^3$
Average Concentration over 24 hours -		(APR-OCT) 1.72 $\mu\text{g}/\text{m}^3$ (OCT-APR) 3.44 $\mu\text{g}/\text{m}^3$
<u>B. Ontario Occupational Health Guidelines:</u>		
Threshold Limit Value -		3 ppm; 2000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -		
<u>C. Occupational Standards (TLV) Elsewhere:</u>		
	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany	3	2000
Sweden	3	2000
<u>D. Additional information:</u>		
- TLV (U.S.) of 3 ppm adopted to prevent irritating effects		
- Soviet TLV (1966) 0.7 ppm		
- Czechoslovakia (1969) 1.2 ppm		
- American National Standards Institute TLV (1966) 3 ppm		

IV

COMMENTSHydrogen Fluoride:

- Fluorinating agent in organic and inorganic reactions
- Production of fluorine, aluminum fluoride and aluminum
- catalyst in alkylation, isomerization and polymerizing reactions

Hydrofluoric Acid:

- Polishing, etching of glass
- Source of fluorine for aluminum production
- Pickling and electropolishing agent for metals.

IODINE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1 mm Hg at 38.7 C
Chemical Formula -	I ₂
Molecular Weight -	253.8
Boiling Point -	184 C
Melting Point -	113.5 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Violet-black crystals, metallic lustre	
- Readily sublimes to violet vapor	
- Characteristic odor	
- Soluble in alcohol and common organic solvents	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	
Additional Information -		
- More irritating and corrosive than chlorine and bromine		
- Irritative to eyes, skin, upper respiratory tract, and lungs.		

IODINE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (ceiling) 0.1 ppm; 1000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany	0.1	1000 (ceiling)
Sweden	0.1	1000 (ceiling)

D. Additional information:

- TLV (U.S.) of 0.1 ppm adopted to prevent irritative effects
- Soviet TLV (1967) 0.1 ppm
- U.S. Occupational Standard: Ceiling Value 0.1 ppm

IV

COMMENTS

- Used in manufacture of dyes and pharmaceuticals

IRON AND IRON COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Iron	Fe	55.85	S		3000	1536	INSOL.
Blue							
2-Ethylhexoate							
Napthenate							
Oxides	Fe ₂ O ₃	159.68	S			decomp.	INSOL.
Oxide, Synthetic	Fe ₃ O ₄	231.54				1538	INSOL.
Selenide							
Sorbitol							
Tallate	Salt of tall oil mixture of rosin acids and fatty acids.						
<u>Ferric or Ferrous</u>							
-ic Chloride	FeCl ₃	162.22	S		319	282	SOL.
-ic Nitrate	Fe(NO ₃) ₃ .6H ₂ O	349.96	S			35	SOL.
Ferrocene	C ₁₀ H ₁₀ Fe	186	S			174	INSOL.
-ous Fumarate	FeC ₄ H ₂ O ₄	170	S				SOL.
-ous Phosphide	Fe ₂ P	142.68	S				INSOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	Inhalation	Irritant
Acute Local -	0	0
Acute Systemic -	1	
Chronic Local -	0	0
Chronic Systemic -	3	

Additional Information -

- iron dust can be irritative and cause injury to eye.
- inhalation of iron oxide fume causes siderosis, pulmonary fibrosis and an increased incidence of lung cancer(as co-carcinogen
- also causes chronic bronchitis and metal fume fever
- iron compounds are suspected carcinogens of the lung, liver, connective tissue.
- Some iron compounds found to be carcinogenic in animal experiments.

IRON AND IRON COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Ferric oxide: 75 ug/m^3
metallic iron 10 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Iron oxide fume: 5000 ug/m^3
Iron pentacarbonyl: 0.01 ppm, 80 ug/m^3
(Over 8 Hours) - Soluble iron salts: 1000 ug/m^3 (as Fe)

C. <u>Occupational Standards (TLV) Elsewhere:</u>		<u>ppm</u>	<u>ug/m^3</u>
West Germany	Iron oxide fume:	-	8000
	Iron pentacarbonyl	0.1	800
Sweden	Iron oxide fume:		5000

D. Additional Information:

- U.S. Occupational Standard₃ for iron oxide fume: time weighted average 10000 ug/m^3

IV. COMMENTS

KEROSENE

I PROPERTIES

Physical State (ambient temp.) -

L

Vapour Pressure (25°C) -

Chemical Formula - Mixture of petroleum hydrocarbons (C₁₀-C₁₆ aliphatics)

Molecular Weight -

Boiling Point -

175-325 C

Melting Point -

Solubility in Water -

Insoluble

Additional Information -

- Synonym: fuel oil No.1
- pale, yellow - white, oily liquid

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -	2	

Additional Information -

- inhalation may cause headache and stupor
- skin irritant
- ingestion cause gastrointestinal irritation

KEROSENE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- rocket and jet engine fuel
- domestic heating
- solvent
- insecticide
- diesel and tractor fuels

LEAD AND LEAD COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Lead	Pb	207.2	S		1755	327.4	
Acetate	Pb(C ₂ H ₃ O ₂) ₂	810.0	S			280	V. SOL.
Azide	Pb(N ₃) ₂	291.23	S		Explodes 350		SL. SOL.
Azotetrazole							
Carbonate	PbCO ₃	267.20	S			decomp 315	
Chloride	PbCl ₂	278.10	S		950	501	SOL.
Chromate	PbCrO ₄	323.18	S			844	INSOL
Dinitroresorcinat							
2-Ethyl hexoate			L				
Fluoborate							
Fumarate			S				
Isodecanoate							
Naphthenates						100	
Neodecanoate							
Nitrate	Pb(NO ₃) ₂	331.2				470	V. SOL.
Dioxide	PbO ₂	239.19	S			290	INSOL.
Monoxide	PbO	223.19	S			888	SL. SOL.
Tetroxide	Pb ₃ O ₄	685.57	S		1472	890	INSOL.
Sesquioxide	Pb ₂ O ₃	462.38	S			370	INSOL.
Suboxide	Pb ₂ O	430.38	S			decomp.	INSOL.
Perchlorate	Pb(ClO ₄) ₂ · 3H ₂ O	460.14	S			decomp. V. 100 C	SOL.
Ortho-phosphite	PbHPO ₃	287.17	S			decomp	INSOL.
Phthalate	C ₆ H ₄ (COO) ₂ Pb · PbO	594	S				
Silicate	PbSiO ₃	283.27				766	INSOL.

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Stearate	$\text{Pb}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	774.15	S			115.7	SL.SOL.
Styphnate	$\text{C}_6\text{H}(\text{NO}_2)_3(\text{O}_2\text{Pb})$					detonates 260	
Sulphate	PbSO_4	303.25				decomp 1000	SL.SOL.
" basic	$\text{PbSO}_4 \cdot \text{PbO}$	526.44				977	SL.SOL.
Tallate	Salt of tall oil mixture of rosin acids and fatty acids						
Tetraethyl	$\text{Pb}(\text{C}_2\text{H}_5)_4$	323.5	L	< 1 mm	198- 202 C	125- 150 C	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	0	0
Acute Systemic -	3	
Chronic Local -	0	0
Chronic Systemic -	3	

Additional Information -

- intake through inhalation, ingestion or through skin (particularly organic cpds)
- symptoms develop more rapidly when lead inhaled
- cumulative poison; increasing amounts build up in body
- toxicity of various compounds depends on their solubility in body fluids, and particle size. Carbonate, Monoxide, Sulfate are most toxic
- producing varying symptoms depending on type and degree of exposure
- several lead compounds (acetate, carbonate, chromate, phosphate, subacetate) are recognized animal carcinogens. Lead and compounds are suspected carcinogens of lungs and kidneys.

LEAD AND LEAD COMPOUNDS (3)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: (as Pb)
10 ug/m³

Average Concentration over 24 hours - 5.0 ug/m³

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Lead, Inorganic Comps: 150 ug/m³
Lead, Arsenate: 150 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany Lead, Inorganic Comps: 200 ug/m³

Sweden Lead, Inorganic Comps: 100 ug/m³

D. Additional Information:

- Soviet TLV (1966) 10 ug/m³
- East and West Germany, Holland TLV 200 ug/m³
- Great Britain, Yugoslavia TLV 150 ug/m³
- Czechoslovakia, Poland, Japan TLV 50 ug/m³
- Hungary TLV 20 ug/m³
- American National Standards Institute TLV(1969) 200 ug/m³
- U.S. Occupational Standard for Lead: Time Weighted Average 200 ug/m³

IV COMMENTS

MAGNESIUM AND MAGNESIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Magnesium	Mg	24.305			1107	650	INSOL.
Acetate	$\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$	142.4	S			decomp. 323	V.SOL.
Bile Salts							
Calcium Carbo- nate							
Chloride	MgCl_2	95.22	S		1412	708	V.SOL.
Hydroxide	$\text{Mg}(\text{OH})_2$	58.33	S				SL. SOL.
Lauryl Sulphate							
Lignosul- phonates							
Naphthenates							
Nitrate	$\text{Mg}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$	184.35	S			129	SOL.
Oxide	MgO	40.31	S		3600	2800	SLSOL.
Salicylate	$\text{Mg}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 4\text{H}_2\text{O}$	370.61	S				SOL.
Silicate	MgSiO_3	100.40	S			decomp. 1557	INSOL.
Stearate	$\text{Mg}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	591.27	S			186-188	SL.SOL.
Sulphate	MgSO_4	120.37	S			decomp. 1124	V.SOL.
Xylene Sulphonate							

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -		

Additional Information -

- inhalation of freshly sublimed oxide may cause metal fume fever. No evidence of systemic poisoning.
- irritative to skin. Particles embedded in skin can produce severe local lesions characterized by evolution of gas and acute inflammatory reaction

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Magnesium Oxide:
100 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Magnesium Oxide fume: 10000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany MgO 8000 $\mu\text{g}/\text{m}^3$

Sweden

D. Additional Information:

MALEIC ANHYDRIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	0.387 mm Hg
Chemical Formula -	OCOCCHCHCO
Molecular Weight -	98.06
Boiling Point -	198 C
Melting Point -	60 C
Solubility in Water -	Soluble
Additional Information -	
- Synonym: Toxic Anhydride, cisbutenedioic Anhydride	
- Fused black or white crystals	
- Hydrolyzes slowly in water	
- Soluble in acetone, hydrocarbons, ether, chloroform, petroleum ether	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- inhalation can cause pulmonary edema		
- subacute inhalation leads to severe headache, nosebleed, nausea and temporary impairment of vision		
- closely resembles and is more potent than Phthalic Anhydride in its toxicologic properties of skin, eye, and upper respiratory tract irritation.		
- Carcinogenic in some animal experiments		

MALEIC ANHYDRIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 0.25 ppm; 1000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany	0.2	800
Sweden	0.3	1000

D. Additional Information:

- TLV (U.S.) of 0.25 ppm adopted on basis of analogous but more severe toxic action in comparison with Phthalic Anhydride.

IV

COMMENTS

- Used primarily in making polyester resins. Also used in production of Fumaric Acid, Insecticides (such as Malathion), Maleic Hydrozide, and Alkyd Resins.

MANGANESE AND MANGANESE COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Manganese	Mn	54.94	S		2097	1245	INSOL.
Carbonate	MnCO ₃	114.95	S				SL. SOL
Dioxide	MnO ₂	86.94	S				INSOL.
2-Ethylhexoate							
Isodecanoate							
Linoleate							
Naphthenate							
Neodecanoate							
Soaps							
(II) Sulphate	MnSO ₄	151.00			850	700	V. SOL
Tallate	Salt of tall oil mixture of rosin acids and fatty acids.						

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- main effect of chronic inhalation of manganese dusts and fumes is on central nervous system. Damage may be permanent. Also suspected to cause pneumonitis and upper respiratory infections.

III

III

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: 100 ug/m³
(as Mn)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Metal and compounds: 5000 $\mu\text{g}/\text{m}^3$ (as Mn)
(ceiling)
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere: $\mu\text{g}/\text{m}^3$

West Germany	Metal and compounds: (ceiling)	5000 (as Mn)
--------------	-----------------------------------	--------------

Sweden Metal and compounds: 2500 (as Mn)
(ceiling)

D. Additional Information:

- Soviet TLV (1966) 300 $\mu\text{g}/\text{m}^3$
- Czechoslovakia TLV (1969) 2000 $\mu\text{g}/\text{m}^3$
- American National Standards Institute TLV (1948) 6000 $\mu\text{g}/\text{m}^3$

IV

COMMENTS

- about 90% used in metallurgy
 - alloying agent in steels
 - alloying agent in Al, Sb, Cu (improve corrosion resistance and hardness)
 - purifying and scavenging agent in metal production
- Remainder consumed by chemical industry.

MERCURY AND MERCURY COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Mercury	Hg	200.59	S		356.6	-38.9	INSOL.
-ic Chloride	HgCl ₂	271.50	S	< 1 mm	302	276 decomp.	SOL.
-ic Nitrate	Hg(NO ₃) ₂ · 1/2 H ₂ O	336.61				79	V. SOL.
-ic Oxide	HgO	216.59				decomp. 500	SL. SOL.
-ous Nitrate	Hg ₂ (NO ₃) ₂ · 2H ₂ O	561.22				70	decomp.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	3	
Additional Information -		

- readily absorbed via respiratory tract, intact skin and gastrointestinal tract
- circulates in blood and stored in liver, kidneys, spleen, and bone.
- causes damage to central nervous system. Also kidney damage.
- soluble salts are corrosive to skin and mucous membranes. Causes dermatitis
- causes inflammation of mouth and gums

MERCURY AND MERCURY COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: $5.0 \mu\text{g}/\text{m}^3$
 Alkyl : $1.5 \mu\text{g}/\text{m}^3$
 compounds
 Average Concentration over 24 hours - $2.0 \mu\text{g}/\text{m}^3$

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Alkyl compounds: $.001 \text{ ppm}$; $10 \mu\text{g}/\text{m}^3$
 -skin
 (Over 8 Hours) - all forms $50 \mu\text{g}/\text{m}^3$

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany		
Alkyl compds - skin:		10
all forms:	.01	100
Sweden		
Alkyl compds - skin:		10
all forms:		50

D. Additional Information:

All forms except Alkyl

- Soviet TLV (1967) $10 \mu\text{g}/\text{m}^3$
- Czechoslovakia TLV (1969) $50 \mu\text{g}/\text{m}^3$
- American National Standards Institute TLV (1943) $100 \mu\text{g}/\text{m}^3$

Alkyl Compounds

- American National Standards Institute TLV (1969) $10 \mu\text{g}/\text{m}^3$

IV

COMMENTS

- major uses (with percentages of total consumption) are as follows
 - electrical apparatus 28.3%
 - electrolytic preparation of chlorine and caustic soda 20.2%
 - paints 18.4%
 - industrial and control instruments 8.1%
 - Pharmaceuticals 7.8%
 - Agricultural 7.3%
 - Catalysts 1.9%
 - Pulp and paper 1.4%

METHYL CHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25 ⁰ C) -	
Chemical Formula -	CH ₃ Cl
Molecular Weight -	50.5
Boiling Point -	-23.7 C
Melting Point -	-97.7 C
Solubility in Water -	Slightly Soluble
Additional Information -	

- Synonyms: Chloromethane, Monochloromethane
- colorless gas; faintly sweet, ether-like odour
- soluble in alcohol and other common organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	1	1
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	2	

Additional Information -

- weak irritant and weak narcotic
- repeated low-level exposure causes damage to the central nervous system, liver, kidneys, bone marrow, and cardiovascular system
- high-level exposures may be fatal owing to degenerative changes in the heart, liver, and especially the kidneys

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - In preparation

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 210,000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	50	105,000

Sweden

D. Additional information:

- U.S. Occupational Standard
 - Time Weighted Average: 100 ppm
 - Ceiling Value 200 ppm
 - Peak Value 300 ppm (5 min/3hours)
- Soviet TLV (1967) 2.5 ppm
- Czechoslovakia TLV (1969) 50 ppm
- American National Standards Institute TLV (1969) 100 ppm

IV

COMMENTS

- Methylating agent in organic synthesis
- used as a propellant, refrigerant, and in the production of tetramethyl lead, silicones
- used in low temperature polymerization

METHYLCHLOROMETHYL ETHER

I PROPERTIES

Physical State (ambient temp.) - L
Vapour Pressure (25°C) -
Chemical Formula - $\text{CH}_2\text{ClOCH}_3$
Molecular Weight - 76.5
Boiling Point - 59.5
Melting Point - -103.5 C
Solubility in Water - decomposes

Additional Information -

- synonyms: Dimethylchloroether, Chloromethyl Methyl Ether, Mono-chlorodimethyl ether, CMME
- clear, colorless liquid
- Soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- recognized as a carcinogen by OSHA (U.S.), Germany, Sweden

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

METHYLENE CHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	428 mm Hg
Chemical Formula -	CH ₂ Cl ₂
Molecular Weight -	84.9
Boiling Point -	39.8 C
Melting Point -	-96.7 C
Solubility in Water -	Slightly Soluble
Additional Information -	

- Synonyms: Dichloromethane
- colorless volatile liquid
- penetrating, ether-like odor
- soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	1	

Additional Information -

- irritating to the eyes and respiratory tract, and may produce pulmonary edema
- one of the least toxic chlorinated hydrocarbons. But its narcotic powers are quite strong and it may produce central nervous depression. Human fatalities have occurred.

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design
Standard: 100,000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 200 ppm; 720,000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	500	1,750,000
Sweden	100	350,000

D. Additional Information:

- TLV (U.S.) of 100 ppm is adopted to prevent any significant narcotic effects
- American National Standards Institute TLV (1969) 500 ppm
- Soviet TLV (1967) 15 ppm
- Czechoslovakia (1969) 140 ppm
- U.S. Occupational Standards
 - Time Weighted Average 500 ppm
 - Ceiling Value 1000 ppm
 - Peak Value 2000 ppm (5 min/2 hours)

IV

COMMENTS

- used as paint remover, refrigerant, degreasing solvent, fumigant, local anesthetic, propellant
- used in pharmaceutical, food, and textile and leather industries

4,4' - METHYLENE (bis) 2-CHLOROANILINE

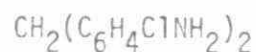
I PROPERTIES

Physical State (ambient temp.) -

S

Vapour Pressure (25°C) -

Chemical Formula -



Molecular Weight -

Boiling Point -

Melting Point -

99-107

Solubility in Water -

Additional Information -

- Synonyms: MBCA, 3,3' - dichloro -4,4' - diaminodiphenylmethane
- tan coloured solid
- soluble in acetone, esters, and aromatic agents.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- regarded as a carcinogen by OSHA (U.S.) and Sweden

III

4,4 - METHYLENE (bis) 2 - CHLOROANILINE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Health Standard: Carcinogen

IV

COMMENTS

- Used as a curing agent for several elastomers and epoxy resins.

MOLYBDENUM AND MOLYBDENUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Molybdenum	Mo	95.94	S		5560	2610	INSOL.
Molybdate Orange							
Disulphide	MoS ₂	160.07	S			1185	INSOL.
Dioxide	MoO ₂		S				INSOL.
Trioxide	MoO ₃	143.94	S		1155	795	SOL.
(III) Oxide	Mo ₂ O ₃	239.90	S				INSOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -		
Chronic Local -		
Chronic Systemic -	1	

Additional Information -

- Molybdenum Cpd's: no reported cases of industrial poisoning. Rapidly excreted by body; not stored.
- General agreement that Molybdenum compounds exhibit low order of toxicity

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

		<u>ug/m³</u>
Threshold Limit Value -	Soluble Compounds:	5000
(Over 8 Hours) -	Insoluble Compounds:	10000

C. Occupational Standards (TLV) Elsewhere:

		<u>ug/m³</u>
West Germany	Soluble Compounds:	5000
	Insoluble Compounds:	10000
Sweden		

D. Additional Information:

- Soviet TLV (1966); Soluble compounds 4000 ug/m³
Insoluble Compounds 6000 ug/m³

IV

COMMENTS

- about 85% of all Mo produced is used as an alloying agent in iron-base alloys (alloy steels, stainless steels, tool steels, alloy cast iron)
- remainder used in production of Mo chemicals.

MORPHOLINE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	6.6 mm at 20 C
Chemical Formula -	$\text{OCH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2$
Molecular Weight -	87.1
Boiling Point -	128 C
Melting Point -	-4.8 C
Solubility in Water -	Very Soluble
Additional Information -	
<ul style="list-style-type: none">- Synonyms: Tetrahydro - 1,4 - oxazine, Diethylenimide oxide- colorless, hygroscopic oil; volatile with steam- characteristic amine-like odor- soluble in organic solvents- strongly alkaline	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- liquid and vapor are irritating to skin, eyes, and mucous membranes
- has produced kidney and liver damage in experimental animals
- industrial use has resulted in some cases of respiratory tract irritation but no chronic effects have been reported

III MORPHOLINE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 20 ppm; 70000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	20	70000

Sweden

D. Additional Information:

- U.S. TLV of 20 ppm adopted to prevent irritation and harmful effects on the eyes

IV COMMENTS

- used as a solvent for resins, waxes, dyes
- morpholine fatty acid salts are used as surface active agents and emulsifiers
- other morpholine compounds are used as corrosion inhibitors, anti-oxidants, plasticizers, insecticides and herbicides.

NAPHTHALENE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	0.0866 mm Hg
Chemical Formula -	C ₁₀ H ₈
Molecular Weight -	128.2
Boiling Point -	217.9 C
Melting Point -	80.1 C
Solubility in Water -	Slightly Soluble

Additional Information -

- Synonyms: Tar Camphor, White tar, Naphthene, Moth Flakes
- most abundant single component of coal tar
- white crystalline, volatile flakes. Sublimes slowly at room temperature
- strong aromatic odor
- moderately soluble in benzene, very soluble in alcohol and ether.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	1	

Additional Information -

- irritating to eyes
- inhalation can cause headache, nausea, and loss of appetite
- Injury to the cornea and kidney damage have also been reported.

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

10 ppm; 50000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	10	50000

Sweden

D. Additional Information:

- U.S. TLV OF 10 ppm is adopted to prevent corneal injury.

IV

COMMENTS

- about 75% of total production used in the production of phthalic anhydride
- an intermediate in production of various products (naphthol, "Tertralin", "Decalin", chlorinated naphthalenes)
- chlorinated naphthalenes used as solvents for fire proofing and waterproofing fabrics
- used as an insecticide

NAPHTHYLAMINE (α and β)

I PROPERTIES

Physical State (ambient temp.) - S
Vapour Pressure (25°C) - 1 mm Hg @ 106 C
Chemical Formula - $C_{10}H_7NH_2$
Molecular Weight - 143.2
Boiling Point - 300 C (for α); 306C (for β)
Melting Point - 50C (for α); 112C (for β)
Solubility in Water - α : slightly soluble
Additional Information - β : soluble

α form

- synonyms: 1-Naphthylamine, 1-Aminonaphthalene, Naphthalidam, Naphthalidine
- White crystals, reddening on exposure to air
- Soluble in alcohol and ether
- Unpleasant odor

β form

- Synonyms: 2-Naphthylamine, 2-Aminonaphthalene, 2-Naphthalamine, 2- Naphthalamine
- White to faint pink flakes. Faint aromatic odor
- Soluble in alcohol, ether, benzene

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- can be absorbed into body via lungs, gastrointestinal tract, and skin
- long and continued exposures to even small amounts can produce tumors and cancers of the bladder
- recognized as a carcinogen by OSHA (U.S.), Germany, and Sweden

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

- used as dyes and dye intermediates.

NICKEL AND NICKEL COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25 C	B.P. C	M.P. C	Sol In H ₂ O
Nickel	Ni	58.71			2900	1455	INSOL.
Carbonate	NiCO ₃	118.72	S		decomp.		SL.SOL.
Carbonyl	Ni(CO) ₄	170.75	L or S		43	-25	SL.SOL.
Chloride	NiCl ₂	129.62	S		Subl. 973	1001	V.SOL.
2-Ethylhexoate							
Ferrite							
Oxide	NiO	74.71	S			1990	INSOL.
(II) Acetate	Ni(C ₂ H ₃ O ₂) ₂	176.80	S		16.6	decomp.	INSOL.
Selenide	NiSe	137.67	S				INSOL.
Subsulfide	Ni ₃ S ₂	240.26	S			790	INSOL.
Sulphate	NiSO ₄	154.78	S			decomp. 848	V.SOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		3
Chronic Systemic -	3	

Additional Information -

- Several compounds are recognized carcinogens
 - Human: Ni(CO)₄ (U.S. Sweden)
 - Ni (respirable) (Sweden, West Germany)
 - Animal: Ni(CO)₄ (West Germany)
- suspected carcinogens: Nickel subsulfide, Nickel Oxide
- Lung and sinus cancers observed in Nickel workers
- Respiratory disorders, gastric and laryngeal cancers and various sarcomas also observed
- causes chronic dermatitis

NICKEL AND NICKEL COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Nickel: 5 ug/m^3
Ni(CO)₄: 1.5 ug/m^3

Average Concentration over 24 hours - 2.0 ug/m^3

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Metal, Insoluble Compounds: 1000 ug/m^3 (as Ni)
Soluble compounds: 100 ug/m^3 (as Ni)
(Over 8 Hours) - Nickel Carbonyl: 0.1 ppm ; 700 ug/m^3

C. Occupational Standards (TLV) Elsewhere:

	<u>ppm</u>	<u>ug/m³</u>
West Germany		

Sweden	metal, insoluble compounds :	10
--------	------------------------------	----

D. Additional Information:

IV

COMMENTS

NITRIC ACID

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	60.8 mm Hg
Chemical Formula -	HNO ₃
Molecular Weight -	63.01
Boiling Point -	83 C
Melting Point -	-42 C
Solubility in Water -	Very Soluble

Additional Information -

- Synonyms: Aquo Fortis, Azotic Acid, Hydrogen Nitrate
- transparent, colorless, or yellowish, fuming liquid. A strong monobasic acid. Powerful oxidizing agent
- releases NO₂ on exposure to light, giving rise to yellow discoloration
- characteristic choking odor
- attacks almost all metals. Decomposes violently in alcohol
- exact composition of "fumes" or vapor depends on temperature, humidity and whether or not the acid is in contact with other materials such as heavy metals or organic compounds. Vapor may consist of a mixture of various nitrogen oxides and of nitric acid vapor.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -		

Additional Information -

- irritant to mucous membranes of eyes and respiratory tract, and to skin
- vapor and mist are corrosive to teeth
- continued exposure to vapor may cause chronic bronchitis and pulmonary edema; more severe exposure may cause chemical pneumonitis
- usually found in conjunction with NO₂ which is more hazardous

NITRIC ACID (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 2 ppm; 5000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. <u>Occupational Standards (TLV) Elsewhere:</u>		
	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	10	25000
Sweden	2	5000

D. Additional Information:

- U.S. TLV of 2 ppm adopted to prevent irritation and corrosion

IV

COMMENTS

- about 75% used in manufacture of agricultural fertilizers (NH_4NO_3). About 15% used in explosives (nitrates and nitro-compounds). About 10% used by chemical industry.
- paint and varnish manufacture; photographic industry; petroleum refineries; pharmaceuticals, medicine; toilet preparations, metallurgy.

4 - NITROBIPHENYL

I PROPERTIES

Physical State (ambient temp.) - S
Vapour Pressure (25°C) -
Chemical Formula - $C_{12}H_9NO_2$
Molecular Weight - 199.21
Boiling Point - 340 C
Melting Point - 114 C
Solubility in Water - Insoluble
Additional Information -

- Synonyms: p-Nitrobiphenyl; p-Phenylnitrobenzene; 4-Phenylnitrobenzene
- Soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		

Additional Information -

- recognized as a carcinogen by OSHA (U.S.); and Sweden
- has caused cancer of the bladder in humans

4 - NITROBIPHENYL (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

N-NITROSODIMETHYLAMINE

I

PROPERTIES

Physical State (ambient temp.) - L

Vapour Pressure (25°C) -

Chemical Formula - $C_2H_6N_2O$

Molecular Weight - 74.1

Boiling Point - 152 C

Melting Point -

Solubility in Water - Soluble

Additional Information -

- Synonyms: Dimethylnitrosoamine, DMN
- yellow liquid
- soluble in alcohol and ether

II

HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- highly toxic especially by skin contact
- has caused fatal liver disease in humans
- recognized as a carcinogen by OSHA (U.S.), Germany and Sweden
- no contact by any route should be permitted

N-NITROSODIMETHYLAMINE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

- formed in ambient air by photochemical reaction between NO_x and dimethylamine

I OXALIC ACID
PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	0.0065 mm Hg @ 55 C
Chemical Formula -	COOHCOOH • 2 H ₂ O
Molecular Weight -	126.1
Boiling Point -	Sublimes at 150 C
Melting Point -	101 C (anhydrous 189 C)
Solubility in Water -	Soluble
Additional Information -	
- Synonym: Ethanedioic Acid	
- Transparent, colorless crystals	
- soluble in alcohol and ether, insoluble in benzene	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -	3	3
Chronic Systemic -	2	

Additional Information -

- systemic effects are most severe for ingestion. Poisoning by ingestion can be quickly fatal
- airborne dust and vapor are irritative to the eyes and upper respiratory tract, and cause ulceration of mucous membranes of the nose and throat, general irritability, headaches
- severe exposures cause albuminura , chronic cough, vomiting, general emaciation and weakness
- has a caustic effect on skin and may cause dermatitis

OXALIC ACID (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

1000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- used as a metal cleanser, purifying agent and as an intermediate for many compounds.
- used in leather tanning, and as a paint remover.

PENTAERYTHRITOL

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	
Chemical Formula -	$C(CH_2OH)_4$
Molecular Weight -	136.1
Boiling Point -	276 C (30 mm)
Melting Point -	262 C
Solubility in Water -	Soluble

Additional Information -

- Synonyms: Pentek, Tetramethylomethane, Monopentaerythritol
- crystalline, white powder; odorless
- slightly soluble in alcohol. Insoluble in other common organic liquids

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- Low toxicity. Regarded as a nuisance dust.

PENTAERYTHRITOL (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

10000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV COMMENTS

- used in manufacture of synthetic resins, and in the paint and varnish industry
- also used in pharmaceuticals, insecticides, synthetic lubricants, and as plasticizers.

PHENOL

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1.64 mm Hg @ 40.1 C
Chemical Formula -	C ₆ H ₅ OH
Molecular Weight -	94.1
Boiling Point -	181.8 C
Melting Point -	43 C
Solubility in Water -	Soluble
Additional Information -	

- synonyms: carbolic acid, hydrobenzene, phenic acid, phenylic acid, benzophenol
- white crystalline solid. Acquires red color when exposed to air and light. Absorbs water
- sharp burning taste; characteristic sweet odor
- very soluble in alcohol and common organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -		2
Chronic Systemic -	2	

Additional Information -

- a protoplasmic, systemic poison. Very irritant to tissue. Very readily absorbed through the skin

Acute Poisoning

- main effect is on central nervous system. Absorption via skin can be fatal. Where death is delayed, damage to kidneys, liver, pancreas, spleen, and pulmonary edema may result.

Chronic Poisoning

- causes digestive disturbances, nervous disorders and skin eruptions. May cause damage to kidneys and liver
- causes dermatitis - stated to be a cocarcinogen

PHENOL (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 5 ppm; 19000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	5	19000

Sweden (skin)	5	19000
---------------	---	-------

D. Additional Information:

- U.S. TLV of 5 ppm adopted to prevent systemic effects via inhalation
- Soviet TLV (1967) 1 ppm
- Czechoslovakia TLV (1969) 5 ppm

IV

COMMENTS

- used in manufacture of phenolic and epoxy resins, various organic chemicals, paint and varnish, pharmaceuticals, and pesticides.

PHOSGENE

I PROPERTIES

Physical State (ambient temp.) -	L or G
Vapour Pressure (25°C) -	1180 mm at 20C
Chemical Formula -	COCl_2
Molecular Weight -	98.92
Boiling Point -	8.2 C
Melting Point -	-128 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Synonyms: Carbonyl Chloride; Carbon Oxychloride; Chloroformyl Chloride; CG	
- Colorless gas, or colorless volatile liquid	
- Strong, suffocating odor, especially when concentrated	
- Soluble in benzene, toluene, acetic acid and most liquid hydrocarbons. Hydrolyzed slowly by water to form HCl and CO.	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- the decomposition in lungs of phosgene to HCl (and CO) results in pulmonary edema, pneumonia, and lung abscess
- inhalation of high concentrations may be quickly fatal
- concentrations of 3-5 ppm cause irritation of eyes and throat. However, irritation is not immediate, even in fatal concentrations, giving no immediate warning that dangerous concentrations are being inhaled.

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 130 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 0.05 ppm ; 200 ug/m^3
(Over 8 Hcurs) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m^3)
West Germany	0.1	400
Sweden	0.05	200

D. Additional Information:

- U.S. TLV of 0.05 ppm is based on human response
- Soviet TLV (1959) 0.1 ppm
- Czechoslovakia TLV (1969) 0.1 ppm

IV

COMMENTS

- used in organic synthesis, especially of isocyanates, polyurethane and polycarbonate resins, carbamates, organic carbonates and chloroformates
- used in manufacture of pesticides, herbicides, and dyes.

PHOSPHINE

I PROPERTIES

Physical State (ambient temp.) -	G
Vapour Pressure (25°C) -	
Chemical Formula -	PH ₃
Molecular Weight -	34.04
Boiling Point -	-85 C
Melting Point -	-133.5 C
Solubility in Water -	Slightly Soluble

Additional Information -

- Synonym: Hydrogen Phosphide
- Colorless gas; disagreeable, garlic-like odor
- soluble in alcohol and ether

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	2	2
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

Additional Information -

- toxic action has not been fully determined. It appears to cause a depression of the central nervous system, and irritation of the lungs. It may also cause pulmonary edema.
- continued exposure to very low concentrations causes anemia, bronchitis, gastrointestinal disturbances, and visual, speech, and motor disturbances
- acute exposures lead to convulsions, coma, and death.

PHOSPHINE

(2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 0.3 ppm; 400 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	0.1	150
Sweden	0.3	400

D. Additional Information:

- Soviet TLV (1967) and Czechoslovakia TLV (1969): 0.07 ppm

IV

COMMENTS

- used in preparation of various organic compounds
- doping agent for solid state electronic components.

PHOSPHORIC ACID

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	.0285 mm Hg @ 20 C
Chemical Formula -	H ₃ PO ₄
Molecular Weight -	98.0
Boiling Point -	
Melting Point -	42.4 C
Solubility in Water -	Very Soluble
Additional Information -	

- Synonym: Orthophosphoric Acid
- Clear, colorless, odorless liquid or transparent crystalline solid, depending on concentration and temperature
- soluble in alcohol. Corrosive to ferrous metals and alloys.
- forms para- and meta- phosphoric acids upon heating to 200 C

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -	2	2
Chronic Systemic -		

Additional Information -

- irritant to eyes and skin
- much less harmful than nitric or sulfuric acid

PHOSPHORIC ACID (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 $\mu\text{g}/\text{m}^3$ (as P_2O_5)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 1000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- about 80% of total production is converted into calcium phosphate and ammonium phosphate for fertilizer
- another major use is production of sodium and potassium phosphates for use in detergents and cleaning compounds
- acid used for pickling and rust proofing of metals
- phosphates included in many other products

PHOSPHORUS (white or yellow)

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	0.0388 mm Hg
Chemical Formula -	P ₄
Molecular Weight -	123.9
Boiling Point -	280 C
Melting Point -	44.1 C
Solubility in Water -	Insoluble
Additional Information -	
- Crystalline, transparent, wax-like solid; non-metallic; colorless to yellow	
- occurs in 3 allotropic forms: white (or yellow), red, and black	
- Insoluble in alcohol. Soluble in some organic solvents (benzene, CS ₂ , etc.) and oils	
- darkens on exposure to light. Exhibits phosphorescence at room temperature	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		
Chronic Systemic -	3	

- Additional Information -
- white phosphorus is most toxic allotope
 - vapors (evolved on burning) are irritative to nose, throat and lungs, eyes, skin, and mucous membranes
 - can be absorbed via lungs. Has an acute effect on liver
 - prolonged, low-level exposure causes damage to bones, particularly the jaw. Also severe effect on teeth
 - airborne phosphorus can damage eyes severely

PHOSPHORUS (white or yellow)(2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ug/m^3
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany 100 ug/m^3

Sweden

D. Additional Information:

- U.S. TLV of 100 ug/m^3 adopted on basis of human response
- Soviet (1967) and Czechoslovakia (1969) TLV: 30 ug/m^3

IV

COMMENTS

- the major consumers of phosphorus are as follows(with percentages of total production):
 - Detergent Phosphates: 50% (likely to change)
 - Liquid Fertilizers: 14%
 - Food, water treatment, pharmaceuticals, various chemicals: 16%
 - Alloys, pyrotechnics, fuel additives, pesticides, plasticizers: 20%

PHTHALIC ANHYDRIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1.0 mm Hg @ 96.5 C
Chemical Formula -	$C_6H_4CO_2CO$
Molecular Weight -	148.1
Boiling Point -	295.1 C
Melting Point -	131.2 C
Solubility in Water -	Slightly Soluble
Additional Information -	
- Synonym: Phthalandione	
- white crystalline needles; mild odor	
- sublimes readily	
- soluble in alcohol	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	1	
Chronic Local -	1	1
Chronic Systemic -		
Additional Information -		
- skin, eye, and upper respiratory irritant		
- exposed workers have developed chronic eye inflammation, chronic bronchitis, and emphysema		
- also a skin sensitizer, and can cause allergic reactions		

PHTHALIC ANHYDRIDE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - $1 \text{ ppm}; 6000 \text{ ug/m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	<u>(ppm)</u>	<u>(ug/m^3)</u>
West Germany		5000
Sweden	2	12000

D. Additional Information:

- Soviet TLV (1967) 0.2 ppm
- Czechoslovakia TLV (1969) 1 ppm

IV

COMMENTS

- used in manufacturing of plastics, resins, paints, varnishes, pesticides, pharmaceuticals, and medicines.

β - PROPIOLACTONE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	
Chemical Formula -	$\text{OCH}_2\text{CH}_2\text{CO}$
Molecular Weight -	72.1
Boiling Point -	155 C
Melting Point -	- 33,4 C
Solubility in Water -	Soluble
Additional Information -	

- Synonyms: 2- Oxetanone; Betaprone; Hydracrylic Acid β-Lactone; 3 - Hydroxypropionic Acid Lactone; 2- Oxetanone; Propanolide; Propiolactone; β - propionolactone; β - proprolactone; Propionic Acid 3 Hydroxy β - Lactone
- Colorless liquid; pungent odor
- Soluble in alcohol and organic solvents
- slowly hydrolyzed to hydroacrylic acid

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		3
Chronic Systemic -		

Additional Information -

- a strong irritant. Most toxic of the lactones
- has produced skin cancer in experimental animals
- recognized as a carcinogen by OSHA (U.S.), Germany, Sweden

β - PROPIDLACTONE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: Carcinogen

IV

COMMENTS

- Used as an intermediate in organic synthesis
- medical use as a sterilizing agent for vaccines, plasma

RESORCINOL

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1 mm Hg at 108.4 C
Chemical Formula -	$C_6H_4(OH)_2$
Molecular Weight -	110.1
Boiling Point -	276.5 C
Melting Point -	110 C
Solubility in Water -	Soluble
Additional Information -	

- Synonyms: 1,3 - benzenediol, Resorcin, m-Dihydroxybenzene
- white crystals; acquires pink color on exposure to air and light
- unpleasant sweet taste
- soluble in alcohol and common organic solvents
- belongs to Phenol class of aromatic organic compounds

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -	2	

Additional Information -

- compare health effects to those of Phenol
- primarily a skin irritant. Can cause injury to eyes, and dermatitis
- can cause systemic effects by acting as a blood and nerve poison
- can be absorbed through the skin when in solution

RESORCINOL (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

10 ppm; 45,000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- pharmaceuticals and medicine, pigments and dry colors,
plastics and synthetic resins, rubber.

SELENIUM AND SELENIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P. 25C	B.P. C	M.P. C	Sol In H ₂ O
Selenium	Se	78.96	S		685	217	INSOL.
Diethyldithio- carbamate	Se [SC(S)N (C ₂ H ₅) ₂] ₄	672.1	S				
Dioxide	SeO ₂	110.96	S	0.15 (30C)		340-350 subl.	V.SOL.
Selenous Acid	H ₂ SeO ₃	128.97	S			decomp. 70	V.SOL.
Selenites	e.g. Na ₂ SeO ₃ ·5H ₂ O	263.01	S				SOL.
Hexafluoride	SeF ₆	192.95	G		-34.5	-46.6	SOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2-3	
Chronic Local -		
Chronic Systemic -		

Additional Information -

- dust fumes of Se can cause serious irritation of eyes and respiratory tract
- suspected carcinogen of liver, thyroid
- inorganic selenium compounds cause dermatitis

SELENIUM AND SELENIUM COMPOUNDS (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Selenium: 20 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Se compounds: 200 ug/m^3 (as Se)

(Over 8 Hours) - Se hexafluoride: .05ppm; 400 ug/m^3

C. Occupational Standards (TLV) Elsewhere: (ug/m^3)

West Germany Se compounds: 100

Sweden Se compounds: 100

D. Additional Information:

- U.S. TLV of 200 ug/m^3 for Se compounds is adopted to prevent systemic effects and minimize irritation of eyes and respiratory tract₃
- Soviet TLV (1959) 100 ug/m^3

IV

COMMENTS

- used in electronics industry, photographic industry, and in glass manufacture
- added to stainless steel and copper alloys to increase machinability

SODIUM CYANIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1 mm Hg @ 817 C
Chemical Formula -	Na CN
Molecular Weight -	49.0
Boiling Point -	1496 C
Melting Point -	563.7 C
Solubility in Water -	Soluble
Additional Information -	

- white, crystalline powder
- slightly soluble in alcohol
- aqueous solutions strongly alkaline; decomposes rapidly on standing

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
<ul style="list-style-type: none">- non-toxic systemically- prolonged, low-level exposure may cause loss of appetite weakness, nausea, and symptoms of irritation of upper respiratory tract and eyes.		

SODIUM CYANIDE (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: 5000 ug/m^3 (time weighted average)

IV

COMMENTS

- used in extraction of gold and silver from ores
- used in electroplating and treatment of metals
- used in production of hydrocyanic acid
- used in manufacture of pigments, dyes, insecticides

SODIUM FLUORIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	1 mm Hg at 1077 C
Chemical Formula -	Na F
Molecular Weight -	42.0
Boiling Point -	1700 C
Melting Point -	993 C
Solubility in Water -	Soluble
Additional Information -	

- Synonym: Villiaumite
- Clear, lustrous crystals or white powder

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		1
Chronic Systemic -	3	

Additional Information -

- highly toxic by inhalation or ingestion
- strong irritant to tissue

SODIUM FLUORIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Total Fluorides

(APR-OCT) 8.6 ug/m³
(OCT-APR) 17.2 ug/m³

Average Concentration over 24 hours -

(APR-OCT) 1.72 ug/m³
(OCT-APR) 3.44 ug/m³

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

- U.S. Occupational Standard: 5500 ug/m³
(time weighted average)

IV

COMMENTS

- Used in fluoridation of water supplies, treatment of steel, wood preservative, insecticide, rodenticide, electroplating, chemical cleaning, glass manufacture.

STYRENE MONOMER

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	7.21
Chemical Formula -	$C_6H_5CHCH_2$
Molecular Weight -	104.1
Boiling Point -	146 C
Melting Point -	-31 C
Solubility in Water -	Insoluble
Additional Information -	
<ul style="list-style-type: none"> - Synonyms: Phenyl Ethylene, Vinylbenzene, Cinnamene - Colorless Liquid: penetrating aromatic odor - Soluble in alcohol and ether - Readily undergoes polymerization when heated or exposed to light 	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -	2	

Additional Information -

- can cause irritation and injury to eyes at vapor concentrations greater than 200 ppm
- toxic effects usually transient
- narcotic at high concentrations
- symptoms of "styrene sickness", after exposure to vapor or mist, include headache, fatigue, depression, stupor, and incoordination.

STYRENE MONOMER (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Tentative Design
Standard: 400 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 420000 ug/m³
(Over 8 Hours) -

C. <u>Occupational Standards (TLV) Elsewhere:</u>		
	(ppm)	(ug/m ³)
West Germany	100	420000
Sweden	50	210000

D. Additional Information:

- U.S. TLV of 100 ppm is set on basis of human response
- American National Standards Institute TLV: 100 ppm
- U.S. OCCUPATIONAL STANDARD
 - Time Weighted Average: 100 ppm
 - Ceiling Value: 200 ppm
 - Peak Value: 600 ppm (5 min/3 hours)

IV

COMMENTS

- important intermediate in chemical synthesis.
Widely used in manufacture of plastics, synthetic rubber, and resins.

SULFURIC ACID

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	.000160 mm Hg
Chemical Formula -	H ₂ SO ₄
Molecular Weight -	98.08
Boiling Point -	338 C
Melting Point -	10.36 C
Solubility in Water -	Very Soluble
Additional Information -	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -	3	3
Acute Systemic -		
Chronic Local -	2	2
Chronic Systemic -		
Additional Information -		

- prolonged inhalation may cause chronic bronchitis. Severe exposure may cause chemical pneumonitis
- inhalation of concentrated vapour can cause serious lung damage
- erosion of tooth enamel of acid plant workers has been reported
- fumes and mists cause coughing and irritation of mucous membranes of eyes and upper respiratory tract
- frequent skin contact causes dermatitis

SULFURIC ACID (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 100 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 1000 ug/m^3

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	ug/m^3
West Germany	1000

Sweden	1000
--------	------

D. Additional Information:

- U.S. TLV of 1000 ug/m^3 is adopted to prevent irritation of respiratory passages and injury to teeth
- Soviet and Czechoslovakia TLV 1000 ug/m^3

IV

COMMENTS

- about 42% used in manufacture of phosphate fertilizers, and 9% used in petroleum refining
- other uses include manufacture of $(\text{NH}_4)_2 \text{SO}_4$ (6%), pigments (5%), explosives (3%)
- used in manufacturing of alcohol (2%), steel pickling (2%)
- uranium processing (2%), copper ore leaching (2%)
- for miscellaneous chemicals and various other uses (24%)

TELLURIUM AND TELLURIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Tellurium	Te	127.6	S		990	450	INSOL.
Dioxide	TeO ₂	159.6	S		1245	733	INSOL.
Hexafluoride	TeF ₆	241.6	G			-37.6	SL.SOL.
Tellurites	e.g. Na ₂ TeO ₃	221.58	S				SL.SOL.
Hydride	H ₂ Te	129.62	G		-2.2	-48.9	V.SOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -	2	
Chronic Local -		
Chronic Systemic -	2	

Additional Information -

- relatively low toxicity. Exposure leads to garlic like odor being imparted to breath, sweat.
- heavy exposures may result in headache, drowsiness, metallic taste, loss of appetite, nausea. Large doses can be fatal.
- the gaseous hexafluoride is highly toxic, as is the unstable hydrogen telluride

III

TELLURIUM AND TELLURIUM COMPOUNDS (2) OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Tentative Standard:

Point of Impingement (half-hour average) - Tellurium: 30 ug/m^3
(all compounds as Te)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - Tellurium: 100 ug/m^3

(Over 8 Hours) - Tellurium Hexafluoride: 0.02 ppm
 200 ug/m^3

C. Occupational Standards (TLV) Elsewhere:

West Germany Tellurium: 100 ug/m^3

Sweden

D. Additional Information:

- Soviet TLV (1967) for Tellurium: 10 ug/m^3

IV

COMMENTS

- used as an additive to metals: lead, steels, copper
- used in rubber vulcanization; added to glass and ceramics as a coloring agent
- used in electronics industry

TETRACHLOROETHYLENE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	17.8 mm Hg
Chemical Formula -	CCl_2CCl_2
Molecular Weight -	165.8
Boiling Point -	121.2 C
Melting Point -	-23.4 C
Solubility in Water -	Insoluble

Additional Information -

- Synonym: perchloroethylene, carbon dichloride
- colourless liquid
- odour like chloroform
- extremely stable chemically
- miscible with alcohol, ether and oils

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		2
Acute Systemic -	2	
Chronic Local -		2
Chronic Systemic -	2	

Additional Information -

- irritant to eyes, skin and respiratory tract
- moderately toxic by skin absorption
- anesthetic affect upon the nervous system
- ingestion may cause damage to the gastrointestinal tract
- subject of current OSHA carcinogenesis inquiry

TETRACHLOROETHYLENE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 670000 ug/m³
 (Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany	100	670000
Sweden	30	200000

D. Additional Information:

- Soviet TLV(1967)	7 ppm
- Czechoslovakia TLV(1969)	37ppm
- American National Standards Institute TLV(1967)	100ppm
- U.S. Occupational Standards Time Weighted Average:	100ppm
Ceiling value:	200ppm
Peak value:	300ppm (5 min/3hours)

COMMENTS

- dry cleaning solvent
- vapour-degreasing solvent
- drying agent for metals

TITANIUM DIOXIDE

I PROPERTIES

Physical State (ambient temp.) -	S
Vapour Pressure (25°C) -	
Chemical Formula -	TiO ₂
Molecular Weight -	79.90
Boiling Point -	
Melting Point -	1860 C (decomposes)
Solubility in Water -	Insoluble
Additional Information -	
- Synonyms: Titanic Anhydride; Titanic Acid Anhydride; Titanic Oxide; Titanium White; Rutile	
- white to black powder depending on purity	

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		
Additional Information -		
- Generally regarded as a nuisance dust		
- very high concentrations may cause irritation of the respiratory tract		

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - Titanium Compounds
100 ug/m³ (as Ti)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 10000 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV

COMMENTS

- TiO₂ is the principal white pigment of commerce. Consumption is as follows (with percentages of total production):

Paints	60%
Paper	14%
Plastics	12%
Printing	3%
Inks	

- remaining uses include rubber, ceramics, and textiles.

TOLUENE

I

PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	26.8 mm Hg
Chemical Formula -	CH ₃ C ₆ H ₅
Molecular Weight -	92.15
Boiling Point -	110.7 C
Melting Point -	-94.5 C
Solubility in Water -	Insoluble

Additional Information -

- Synonyms: Methylbenzene, Phenylmethane, Toluol
- Colorless liquid; benzene-like odor
- Soluble in alcohol, ether, chloroform and many organic liquids
- Chemically, behaves much like benzene

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	2	

Additional Information -

- narcotic in high concentrations
- chronic, low-level exposures may cause anemia. However much less toxic than benzene. No bone marrow injury as with benzene.

TOLUENE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 2000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 100 ppm; 375000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany (skin)	200	750000
Sweden (skin)	100	375000

D. Additional Information:

- U.S. TLV of 100 ppm is set on basis of irritative and narcotic effects observed in workers exposed at concentrations of 200 ppm or higher.
- Soviet TLV (1967) 14 ppm
- Czechoslovakia TLV (1969) 50 ppm
- American National Standards Institute TLV (1967) 200 ppm
- U.S. Occupational Standard, time weighted average: 200 ppm
Ceiling Value 300 ppm
Peak Value: 500 ppm (10 min.)

IV

COMMENTS

- about 50% is used as source of benzene
- used in synthesis of several organic compounds
- used in manufacture of phenol
- used as a solvent for many organic compounds

TOLUENE -2,4 - DIISOCYANATE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	0.01 mm Hg at 20 C
Chemical Formula -	$\text{CH}_3\text{C}_6\text{H}_3(\text{NCO})_2$
Molecular Weight -	174.16
Boiling Point -	251 C
Melting Point -	20 C
Solubility in Water -	Reacts with water.

Additional Information -

- Synonyms: TDI; 2,4 - Tolyene Diisocyanate, meta-tolyene diisocyanate
- clear, faintly yellow liquid ; darkens on exposure to sunlight
- sharp, pungent odor
- reacts with water producing CO_2
- soluble in ether, acetone, and other organic solvents.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		3
Acute Systemic -	3	
Chronic Local -		3
Chronic Systemic -		

Additional Information -

- highly toxic by ingestion and inhalation
- particularly irritating to eyes. Also irritating to skin and respiratory tract
- capable of producing severe dermatitis. Also severe bronchial spasms.

III TOLUENE -2,4 - DIISOCYANATE (2)
OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 1.0 ug/m^3

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -(ceiling) 0.02 ppm ; 120 ug/m^3
(Over 8 HOURS) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m^3)
West Germany(ceiling)	0.02	140
Sweden (ceiling)	0.01	70

D. Additional Information:

- Soviet TLV (1967) 0.07 ppm

IV

COMMENTS

- used in the manufacture of polyurethane foams and other elastomers

1,1,1 - TRICHLOROETHANE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	120 mm Hg
Chemical Formula -	CH_3CCl_3
Molecular Weight -	133.4
Boiling Point -	74.1 C
Melting Point -	- 32.5 C
Solubility in Water -	Insoluble
Additional Information -	

- Synonyms: α - trichloroethane, methyl chloroform
- colourless liquid
- soluble in alcohol, benzene, and acetone

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	1	

Additional Information -

- narcotic effect in high concentration
- less toxic than carbon tetrachloride
- subject of current OSHA carcinogenesis inquiry

1,1,1 - Trichloroethane (2)

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 350 ppm; 1,900,000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	200	1,080,000
Sweden	100	540,000

D. Additional Information:

IV

COMMENTS

- solvent for cleaning precision instruments
- aerosol propellant
- metal degreasing
- pesticide

TRICHLOROETHYLENE

I

PROPERTIES

Physical State (ambient temp.) - L
Vapour Pressure (25°C) - 72.4 mm Hg
Chemical Formula - CHClCCl_2
Molecular Weight - 131.4
Boiling Point - 87.1 C
Melting Point - -73 C
Solubility in Water - Slightly Soluble
Additional Information -

- Synonyms: Ethylene or Ethinyl Trichloride
- Colorless, heavy, mobile liquid; chloroform-like odor
- miscible with common organic liquids

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	3	
Chronic Local -		1
Chronic Systemic -	1	

Additional Information -

- inhalation of high concentrations causes narcosis and anesthesia. Death following severe exposure is attributed to cardiac failure.
- prolonged inhalation of moderate concentrations causes headaches and drowsiness
- possibly some damage to liver and other organs.
- subject of current OSHA carcinogenic inquiry
- found to be carcinogenic in some animal experiments
- subject of current OSHA carcinogenesis inquiry

III

OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 85000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 100 ppm; 535000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	50	260000
Sweden	30	160000

D. Additional Information:

- U.S. TLV of 100 ppm is set on basis of human response
- Soviet TLV (1967) 2 ppm
- Czechoslovakia TLV (1969) 45 ppm
- American National Standards Institute TLV (1967) 100 ppm
- U.S. Occupational Standard: time weighted average 100 ppm
- Ceiling Value: 200 ppm
- Peak Value: 300 ppm (5 min/2hour)

IV

COMMENTS

- About 95% is used as solvent in vapor degreasing applications
- Also used as extraction solvent for fats, oils, waxes, in dry cleaning operations, organic compound synthesis, and as an anaesthetic.

VANADIUM AND VANADIUM COMPOUNDS

I PROPERTIES

Compound	Formula	Mol. wt.	P st.	V.P.	B.P. C	M.P. C	Sol In H ₂ O
Vanadium	V	50.94	S		3000	1717	INSOL.
Pentoxide	V ₂ O ₅	181.90	S		decomp 1750	690	SOL.
Trioxide	V ₂ O ₃	149.90	S			1940	INSOL.

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

Inhalation

Irritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- Vanadium compounds act as irritants to eyes and respiratory tract
- Pentavalent compounds (V₂O₅, vanadates) are more toxic than other forms
- inhalation of V₂O₅ affects the respiratory passages. Tracheitis, bronchitis, emphysema, pulmonary edema, and bronchial pneumonia may occur.

III

A. Ontario Environmental Air Standards:

Average Concentration over 24 hours - 2.0 ug/m³

Threshold Limit Value - Vanadium Pentoxide (as V)
(Over 8 Hours) - Dust: 500 ug/m³
Fume: 50 ug/m³

Vanadium Pentoxide		ug/m ³
West Germany	Dust:	500
	Fume:	100
Sweden	Dust:	500
	Fume:	50

IV

- Consumption of vanadium is largely in form of Ferrovandium for manufacture of steels.

VINYL ACETATE MONOMER

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	107.5 mm Hg
Chemical Formula -	$\text{CH}_3\text{COOCHCH}_2$
Molecular Weight -	86.1
Boiling Point -	73 C
Melting Point -	-100 C
Solubility in Water -	Insoluble

Additional Information -

- colorless mobile liquid. Polymerizes to colorless, transparent, solid on exposure to light
- Soluble in most organic solvents, including chlorinated solvents
- Usually contains an inhibitor such as hydroquinone

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	1	
Chronic Local -		1
Chronic Systemic -		

Additional Information -

- skin and eye irritant. Can cause allergic response in skin
- high concentrations may be narcotic
- from industrial experience, prolonged exposures to low concentrations (5-10 ppm) do not produce chronic effects
- animal experiments show low toxicity

VINYL ACETATE MONOMER (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) -

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -

10 ppm; 30000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	($\mu\text{g}/\text{m}^3$)
West Germany	10	30000

Sweden

D. Additional Information:

IV

COMMENTS

- raw material for polyvinyl acetate

VINYLDENE CHLORIDE

I PROPERTIES

Physical State (ambient temp.) -	L
Vapour Pressure (25°C) -	630 mm Hg
Chemical Formula -	CH ₂ CCl ₂
Molecular Weight -	97.0
Boiling Point -	31.6 C
Melting Point -	-122 C
Solubility in Water -	Insoluble

Additional Information -

- Synonyms: 1,1-Dichloroethylene
- Colorless, volatile liquid. Mild, sweet odor
- Soluble in organic solvents

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		
Acute Systemic -		
Chronic Local -		
Chronic Systemic -		

Additional Information -

- irritant to skin and mucous membranes
- narcotic in high concentrations
- has caused liver and kidney injury in experimental animals
- subject of current OSHA carcinogenesis inquiry

VINYLDINE CHLORIDE (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 26,000 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - 10 ppm; 40,000 $\mu\text{g}/\text{m}^3$

(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

West Germany

Sweden

D. Additional Information:

IV COMMENTS

- intermediate in production of vinylidene polymer plastics (Saran, Velon)
- Also used in adhesives. Component of synthetic fibers.

XYLENES

I PROPERTIES

	<u>meta</u>	<u>ortho</u>	<u>para</u>
Physical State (ambient temp.) -	Liquid		
Vapour Pressure (25°C) - mm Hg	8.04	6.55	8.55
Chemical Formula -	$C_6H_4(CH_3)_2$		
Molecular Weight -	106.2		
Boiling Point -	139 C	144 C	138 C
Melting Point -	-47.9 C	-25.2 C	13.3 C
Solubility in Water -	Insoluble		
Additional Information -			

- Synonyms: m-, o-, p-xylol
- Colorless liquid or white crystalline solid
- Soluble in alcohol, ether, and many organic solvents
- Commercial xylene is a mixture of 3 isomers. Meta and para form usually predominate

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	2	

Additional Information -

- may be narcotic at high concentrations. High concentrations (200 ppm) also cause irritation to eyes, nose, and throat
- gastrointestinal, neurological disturbances, injury to heart, liver, kidneys, nervous system found among xylene workers. But chronic toxicity not well-defined due to benzene as an impurity in commercial xylene. Xylene is less toxic than benzene.

XYLENES (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 2300 ug/m³

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 100 ppm; 435000 ug/m³
(Over 8 Hours) -

C. Occupational Standards (TLV) Elsewhere:

	(ppm)	(ug/m ³)
West Germany (skin)	200	870,000
Sweden (skin)	100	435,000

D. Additional Information:

- U.S. TLV of 100 ppm is adopted to prevent irritant and narcotic effects
- Soviet TLV (1967) 11 ppm
- Czechoslovakia TLV (1969) 45 ppm
- American National Standards Institute TLV(1970) 100 ppm

IV

COMMENTS

- used in synthesis of organic chemicals. Also in manufacture of pesticides, dyes, pharmaceuticals,
- used in non-leaded automobile fuels
- used as solvent for resins, enamels etc.

XYLENES

I PROPERTIES

	<u>meta</u>	<u>ortho</u>	<u>para</u>
Physical State (ambient temp.) -		Liquid	
Vapour Pressure (25°C) - mm Hg	8.04	6.55	8.55
Chemical Formula -	$C_6H_4(CH_3)_2$		
Molecular Weight -		106.2	
Boiling Point -	139 C	144 C	138 C
Melting Point -	-47.9 C	-25.2 C	13.3 C
Solubility in Water -		Insoluble	
Additional Information -			

- Synonyms: m-, o-, p-xylol
- Colorless liquid or white crystalline solid
- Soluble in alcohol, ether, and many organic solvents
- Commercial xylene is a mixture of 3 isomers. Meta and para form usually predominate

II HEALTH EFFECTS (see Toxic Hazard Rating Code):

	<u>Inhalation</u>	<u>Irritant</u>
Acute Local -		1
Acute Systemic -	2	
Chronic Local -		1
Chronic Systemic -	2	

Additional Information -

- may be narcotic at high concentrations. High concentrations (200 ppm) also cause irritation to eyes, nose, and throat
- gastrointestinal, neurological disturbances, injury to heart, liver, kidneys, nervous system found among xylene workers. But chronic toxicity not well-defined due to benzene as an impurity in commercial xylene. Xylene is less toxic than benzene.

XYLENES (2)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:

A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - 2300 $\mu\text{g}/\text{m}^3$

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value - (skin) 100 ppm; 435000 $\mu\text{g}/\text{m}^3$
(Over 8 Hours) -

	<u>Occupational Standards (TLV) Elsewhere:</u>	
	<u>(ppm)</u>	<u>($\mu\text{g}/\text{m}^3$)</u>
West Germany (skin)	200	870,000
Sweden (skin)	100	435,000

D. Additional Information:

- U.S. TLV of 100 ppm is adopted to prevent irritant and narcotic effects
- Soviet TLV (1967) 11 ppm
- Czechoslovakia TLV (1969) 45 ppm
- American National Standards Institute TLV(1970) 100 ppm

IV

COMMENTS

- used in synthesis of organic chemicals. Also in manufacture of pesticides, dyes, pharmaceuticals,
- used in non-leaded automobile fuels
- used as solvent for resins, enamels etc.

I PROPERTIES

Compound

Formula

Mol.
wt.

p
st.

V.P.

B.P.

C

M.P.
C

Sol
In
H₂O

Zinc	Zn	65.37	S	907	419	
Acetate	$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$	183.46	S	decomp.		V.SOL.
Ammonium Bisulphite				200		

Ammonium Chloride						
Chloride	ZnCl_2	136.28	S	732	283	V. SOL.
Chromate	ZnCrO_4	181.36	S			INSOL.

Dibutyldithio- carbamate	$\text{Zn}[\text{SC}(\text{S})\text{N}(\text{C}_4\text{H}_9)_2]_2$	474.2	S	104
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Diethyl "	$\text{Zn}[\text{SE}(\text{S})\text{N}(\text{C}_2\text{H}_5)_2]_2$	361.9			
Dust	Zn	65.37	S	907	419.4 INSOL.

2-Ethylhexoate							
Hydrosulphite	$\text{ZnSO}_3 \cdot 2\text{H}_2\text{O}$	181.46	S		disso.	200	SOL.

Isodecanoate	$\text{Zn}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2$	464.00	S	128	SL.SOL.
--------------	---	--------	---	-----	---------

Lignosulphonates

Mercaptobenzothiazole

Naphthenates	$\text{Zn}(\text{C}_6\text{H}_5\text{COO})_2$	319.7
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Neodecanoate

Nitrate, trihydrate	$\text{Zn}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$	243.43	45.5	V.SOL.
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Oxide	ZnO	81.37	1975	SL 30L
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Peroxide	$\text{ZnO}_2 \cdot 1/2 \text{H}_2\text{O}$	106.38	DTSS00
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Selenide	ZnSe	144.33	> 1100	INSOL.
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Stearate	$\text{Zn}(\text{C}_{18}\text{H}_{35}\text{O}_2)$	632.33	130	INSO
----------	---	--------	-----	------

Sulphate	ZnSO ₄	161.43	dissoC. 600	SOL
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Tallate	Salt of tall oil mixture of rosin acids and fatty acids.
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II HEALTH EFFECTS (see Toxic Hazard Rating Code):InhalationIrritant

Acute Local -

Acute Systemic -

Chronic Local -

Chronic Systemic -

Additional Information -

- inhalation of zinc oxide fume may cause metal fume fever. But quick recovery generally occurs
- zinc chloride fume can cause damage to mucous membranes of respiratory tract. Inhalation may produce severe pneumonitis. It is caustic and can cause ulceration of skin
- several zinc compounds are suspected carcinogens (Dibutyl and Dimethyldithiocarbonate, chromate pigments)

III OCCUPATIONAL AND ENVIRONMENTAL AIR STANDARDS:A. Ontario Environmental Air Standards:

Point of Impingement (half-hour average) - all forms: 100 ug/m³
(as Zn)

Average Concentration over 24 hours -

B. Ontario Occupational Health Guidelines:

Threshold Limit Value -	Zinc chloride fume:	1000 ug/m ³
	Zinc oxide fume:	5000 ug/m ³
(Over 8 Hours) -	Zinc Stearate:	10000 ug/m ³

C. Occupational Standards (TLV) Elsewhere:

		ug/m ³
West Germany	Zinc Oxide Fume:	5000
Sweden	Zinc Oxide Fume:	5000
	Zinc Chloride Fume:	1000

D. Additional Information:

- Soviet TLV (1967) and Czechoslovakia TLV(1969) for ZnO fume: 5000 ug/m³

05.06 Explanatory Notes for Hazardous Substances Handbook

Section 05.01

Hazardous Substances List

All substances on the Hazardous Substances List (HASL) are considered capable of adversely affecting human health when encountered in the atmospheric environment at low to moderate dose levels (expected environmental doses).

Changes in the Hazardous Substances List will be communicated periodically to all parties on this report's mailing list. These communications will probably be in the form of revised pages which are to be inserted in the Handbook (sections 05.01) to replace outdated versions of the HASL. All changes in HASL will be dated.

Category A Compounds:

The substances in this category are judged capable of causing irreversible acute response or chronic illness as a result of a single or brief exposure to a relatively small quantity (low dose). These substances should be considered of highest priority.

Category B Compounds:

The substances in this category are considered capable of causing chronic health effects as a result of exposure to a low concentration (typical of environmental exposure) over a long period of time. These substances should be considered high priority.

Carcinogens:

This subgroup within Category B consists of substances which are officially recognized by the U.S. Occupational Safety and Health Administration (OSHA) to be carcinogenic in man.

Category C Compounds:

The substances in this category have moderate to high acute (single or brief large dose) inhalation toxicity, but low chronic inhalation toxicity or short atmospheric persistence.

Section 05.02

Chemical Usage Identified by Industrial Sector

The Industrial Sector Table is drawn up from a 1974 Environment Canada report prepared by James F. MacLaren Limited (Reference 2 of section 05.05). The usage data is up-to-date information (1970) obtained from Statistics Canada reports. A number of compounds have been added to include all substances on HASL as well as a few related compounds.

Section 05.03

Hazardous Substances Data Base Compilation

The Data Base Table is taken in its entirety from the 1976 ARB report prepared by James F. MacLaren Limited (Reference 1 of section 05.05). It contains toxicity data and general information on some 2500 industrial chemicals known or supposed to be used in Ontario. The usage data is up-to-date information (1970) obtained from Statistics Canada reports. This table was the starting point from which HASL was drawn up.

The references listed at the beginning of this section indicate the literature sources used in compiling the Data Base Table.

Section 05.04

Ongoing Priority Substances

This section contains brief summaries on "common" or well-known pollutants which are currently under investigation by the Technology Development and Appraisal Section of ARB. Detailed emission inventory data have been gathered or are in

the process of being gathered. In some cases, detailed reports have been published.

Each summary is self-contained; each summary has its own list of references. The summaries are in alphabetical order and they are not numbered. With this format, additional summaries on other substances could be added periodically.

Section 05.05

Hazardous Substances Data Sheets

The references listed at the beginning of this section indicate the literature sources used in compiling the Data Sheets. The references are grouped under the appropriate sections of the Data Sheets.

The Data Sheets are in alphabetical order. The individual pages are not numbered. With this format, additional Data Sheets on other substances could be added periodically.

I Properties:

All temperatures are given in degrees centigrade. Vapor pressures (V.P.) are given in millimeters (mm) of Hg. Unless otherwise specified, vapor pressures are values at 25 C.

Wherever possible, a description is given of the characteristic odor of substances. More quantitative odor information is given in the Data Base Table (Section 05.03) for a number of substances, in terms of odor threshold values. It should be noted that the values which are quoted in the Data Base Table (section 05.03) represent the lowest values found in the literature.

Unless otherwise indicated, the melting and boiling points which are given are values at 760 mm Hg.

Solubilities in water are expressed as follows: insoluble (insol.), slightly soluble (sl. sol.), soluble (sol.), and very soluble (v. sol.).

Abbreviations:

P. St.: physical state

S: solid L: liquid G: gas

V.P: vapor pressure

M.P.: melting point B.P : boiling point

decomp: decomposes

subl: sublimates

atms: atmosphere

p-: para m-: meta o-: ortho

II Health Effects:

The Toxic Hazard Rating (THR) is given to indicate the relative toxicity of different substances, and is defined elsewhere in the handbook. The THR code is used by Sax (Reference 8 of section 05.05) to describe toxicity by various routes of exposure including inhalation, ingestion, skin absorption, irritation. However, only the inhalation and irritation toxicities are given.

In order to be more accessible to the general reader, the discussion on health effects avoids detailed medical terminology and is deliberately descriptive rather than precise. Furthermore the emphasis is on health effects arising from exposure to the substances in the atmospheric environment.

Substances are referred to as human carcinogens only if they are officially recognized as such by the United States (OSHA, ACGIH), West Germany, and Sweden. All other references to carcinogenicity refer to experimental results in animal toxicity studies (by any or all routes of exposures).

III Occupational and Environmental Air Standards:

The Ontario Occupational Health Guidelines are identical (with only a few exceptions) to the U.S. Threshold Limit Values (TLV), drawn up by the American Conference of Governmental and Industrial Hygienists and adopted as interim standards by the U.S. Occupational Safety Health Administration.

Threshold Limit Values (TLV) refer to airborne, time-weighted average concentrations for a 8 or 10 hour work day and 40 hour work week. They represent conditions under which it is believed that nearly all workers may be repeatedly exposed daily without adverse effects.

The "Skin" notation does not mean that the only effects of a specific substance are on the skin. The notation refers to the fact that, in addition to effects produced by inhalation, there is the possibility that contact with the skin (including mucous membranes and eyes) either by airborne or direct contact, will lead to additional exposure. Furthermore, with this additional exposure, the total exposure may greatly exceed the TLV which is only designed for airborne concentrations.

Substances with a "Ceiling" designation on the TLV are invariably "fast-acting". The Ceiling value represents a boundary beyond which the concentrations should not be allowed to exceed. By contrast, time weighted averages permit brief excursions above the limit.

The Swedish TLV's are time weighted averages (like the U.S. values). The West German TLV's are maximum permissible concentrations, although brief excursions over the limit are permitted.

Where possible, the basis on which the U.S. TLV is established is given. In most cases, protection against impairment of human health is the primary consideration.

The U.S. Occupational Standards refer to the standards promulgated under the U.S. Occupational Safety and Health Act of 1970. The standards may be expressed in terms of time-weighted averages, ceiling values, and peak values. The U.S. Occupational Standard is given only if it is different from the U.S. TLV.